ENVIRONMENTAL PROTECTION AGENCY
40 CFR Part 90
[FRL-]
Phase 2 Emission Standards for New Nonroad Spark-Ignition Engines At or Below 19 Kilowatts

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of Proposed Rulemaking (NPRM).

SUMMARY: Today's action proposes a second phase of regulations to control emissions from new nonroad spark-ignition engines at or below 19 kilowatts (25 horsepower). These engines are used principally in lawn and garden equipment, both in nonhandheld applications such as lawnmowers, and also in handheld applications such as trimmers and chainsaws. The proposed standards are expected to result in a 30 percent reduction of emissions of hydrocarbons plus oxides of nitrogen from the current Phase 1 standards. If adopted, the standards would result in important reductions in emissions which contribute to excessively high ozone levels in many areas of the United States.

DATES: Written comments on this NPRM must be submitted on or before March 13, 1998. EPA will hold a public hearing on February 10, 1998 starting at 10:00; requests to present oral testimony must be received on or before February 6, 1998.

ADDRESSES: Written comments should be submitted (in duplicate if possible) to: EPA Air and Radiation Docket, Attention Docket No. A-96-55, Room M-1500 (mail code 6102), 401 M Street, SW, Washington, D.C. 20460. Materials relevant to this rulemaking are contained in this docket and may be viewed from 8:00 a.m. until 5:30 p.m. weekdays. The docket may also be reached by telephone at (202) 260-7548. As provided in 40 CFR part 2, a reasonable fee may be charged by EPA for photocopying. The public hearing will be held in Ann Arbor, MI at a location to be determined; call (313) 668-4278 for further information.

FOR FURTHER INFORMATION CONTACT: Robert Larson, Office of Mobile Sources, Engine Programs and Compliance Division, (313) 668-4278, larson.robert@epamail.epa.gov.

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List of Subjects in 40 CFR Part 90

I. Regulated Entities. Entities potentially regulated by this action are those that manufacture or introduce into commerce new small spark-ignition nonroad engines or equipment. Regulated categories and entities include:

Category	Examples of Regulated Entities
Industry	Manufacturers or importers of new nonroad small (at or below 19 kW) spark-ignition engines and equipment.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your company is regulated by this action, you should carefully examine the applicability criteria in section 90.1 of title 40 of the Code of Federal Regulations. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding "FOR FURTHER INFORMATION CONTACT" section.

II. Legal Authority and Background

Authority for the actions set forth in this rule is granted to EPA by sections 202, 203, 204, 205, 206, 207, 208, 209, 213, 215, 216, and 301(a) of the Clean Air Act as amended (42 U.S.C. 7521, 7522, 7523, 7524, 7525, 7541, 7542, 7543, 7547, 7549, 7550, and 7601(a)).

In the summer of 1992, EPA initiated a convening process to determine the feasibility of a negotiated rulemaking for the development of the regulatory program for small nonroad spark-ignited (SI) engines at or below 19 kilowatts (hereafter referred to as "small SI engines"). An August 1992 report recommended an "Exploratory Meeting" which was held November 1992. Following meetings in January and June 1993, the group decided to pursue a regulatory negotiation process for the development of Phase 2 regulations for these engines, while EPA developed a first phase of controls for small SI engines through the traditional rulemaking process.

On July 3, 1995, EPA published the Phase 1 final rule, Emission Standards for New Nonroad Spark-ignition (SI) Engines At or Below 19 Kilowatts, hereafter referred to as the Phase 1 small SI engine regulations.[1] The Phase 1 small SI engine regulations established an effective date of model year 1997. Although the Phase 1 regulations were the first to establish nationwide new engine emission standards for this industry, the federal regulations were developed to harmonize with the Tier I[2] standards established by

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[1]60 FR 34582, July 3, 1995, codified at 40 CFR part 90. The docket for the Phase 1 small SI engine rulemaking, EPA Air Docket #A-93-25, is incorporated by reference**.**

[2]The California utility and lawn and garden equipment engine (utility engine) emission regulations are contained in Title 13, California Code of Regulations (CCR), Sections 2400-2407.

California's Air Resources Board.[3]

The engines covered by the existing Phase 1 rule include nonhandheld engines (Class I and II) used in applications such as lawnmowers, generator sets and riding mowers, and handheld engines, (Class III, IV and V), used in applications such as trimmers, edgers, brush cutters, leaf blowers, leaf vacuums, chain saws, augers and tillers. The proposed Phase 2 rules contained in today's notice would apply to the same types of engines and applications covered by Phase 1.

On September 30, 1993, the charter for the Small Nonroad Engine Negotiated Rulemaking Advisory Committee was filed with Congress. The purpose of the committee was to help EPA develop Phase 2 small SI engine regulations. The committee consisted of eleven members representing the range of stakeholders.[4] The committee adopted protocols and formed four task groups to examine key issues and bring recommendations to the full committee. The task groups included: Test Procedure; Technology; Certification; and Public Education and Market Incentives.

The committee and the task groups met numerous times between September 1993 and February 1996, with the final committee meeting on February 16, 1996, in Ann Arbor, Michigan. During the course of its work, the committee addressed many issues, including: applicability of the rule; engine/equipment classification; test procedures for engines; standards and standard structure; effective dates and lead time of the program; certification, enforcement and compliance strategies; in-use program; market-based incentive programs; public education programs; technologies; and dealer responsibility. The committee developed data and draft language to address most of these issues, both through the work of the task groups and the work of the committee as a whole. However, the committee did not reach consensus on an agreement in principle or draft regulatory language during the course of the negotiations. While the committee did not achieve

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[3]Since the July 3, 1995 promulgation of the Phase 1 program, four changes have been made to Phase 1. First, provisions for allowing a streamlined certification process were promulgated May 8, 1996, 61 FR 20738. Second, revisions to the national security exemption provisions were promulgated October 4, 1996, 61 FR 52088. Third, revisions to the carbon monoxide (CO) emission standards for Class I and II engines, and provisions related to crankcase emissions, were promulgated, November 13, 1996, 61 FR 58296. Finally, provisions relating to replacement engines and 2-stroke engines in nonhandheld applications were published August 7, 1997, 62 FR 42637.

[4]The organizations participating in the regulatory negotiations as members of the Committee were: the American Lung Association (ALA); the Auger and Power Equipment Manufacturers Association (APEMA); the Engine Manufacturers Association (EMA); the Manufacturers of Emission Controls Association (MECA); the Natural Resources Defense Counsel (NRDC); the North American Equipment Dealers Association (NAEDA); the Outdoor Power Equipment Institute (OPEI); the Portable Power Equipment Manufacturers Association (PPEMA); the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO); the Wisconsin Department of Natural Resources; and U.S. EPA.

consensus, the regulatory negotiation process produced substantial useful information and provided EPA with input from numerous key stakeholders which has helped EPA develop the Phase 2 small SI engine regulatory program being proposed today.[5] In addition, during the meetings there was much useful discussion which has helped EPA understand the perspectives of the interests represented at the table.[6]

Following the final meeting of the regulatory negotiation committee in February 1996, EPA proceeded to develop the Phase 2 rule. EPA and other interested parties continued working to find areas of agreement on how certain aspects of a Phase 2 program would be addressed in the proposed rule. As these discussions proceeded, the involved parties worked together to develop written documents, Statements of Principles (SOPs), which have partly formed the basis of today's Phase 2 NPRM (see 62 FR 14740, March 27, 1997). A Statement of Principles (SOP) is a joint written statement by the U.S. EPA and supporting parties outlining a comprehensive plan for developing a proposed rulemaking. In this case, the two SOPs lay out the framework for a proposal for Phase 2 regulations covering small handheld and nonhandheld spark-ignited nonroad engines, respectively.

The "Handheld SOP", addressing issues affecting engines used in handheld equipment, was signed in May 1996 by EPA, the Auger and Power Equipment Manufacturers Association (APEMA), the North American Equipment Dealers Association (NAEDA), the Portable Power Equipment Manufacturers Association (PPEMA), the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO), and the Wisconsin Department of Natural Resources. The "Nonhandheld SOP", addressing issues affecting engines used in nonhandheld equipment, was signed in December 1996 by EPA, Briggs & Stratton Corporation, Kawasaki Motors Corporation, U.S.A., Kohler Company, Kubota, Mitsubishi Engine North America, Inc., Onan Corporation, Suzuki Motor Corporation, Tecumseh Products Company, The Toro Company, and Wis-Con Total Power Corporation. While the two SOPs set out a framework for EPA's development of the proposed Phase 2 program, the Agency wishes to stress that they do not represent final decisions regarding Phase 2 or bind EPA as to how provisions in the final rule must be promulgated.

EPA published an Advanced Notice of Proposed Rulemaking (ANPRM) in March 1997 (see 62 Federal Register 14740, March 27, 1997) which announced the signing of the two SOPs and requested comments on all aspects of the SOPs for purposes of developing today's proposal. EPA also specifically requested information on small business issues in the ANPRM. Significant comments received on the ANPRM are

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[5]EPA initially established EPA Air Docket A-93-29 for the Phase 2 rulemaking; this docket contains background materials on this Phase 2 rulemaking, as well as materials related to the Small Nonroad Engine Negotiated Rulemaking process. EPA Air Docket A-93-29 is hereby incorporated by reference.

[6]The final report by the facilitators to the regulatory negotiation process can be found in EPA Air Docket A-93-29, Item #II-A-10.

discussed in the context of the description of the program contained in today's proposal.

III. Overview of Proposed Provisions

EPA is proposing today a second phase of regulations for small SI engines 19 kW and below (hereafter referred to as small SI engines). Two principle goals of the proposed Phase 2 rule are to encourage a shift to cleaner engine technology, and to assure that the air quality benefits anticipated by the rule are achieved in actual use. To achieve these goals, the proposed Phase 2 program builds on the current Phase 1 program in two key ways. First, today's proposal includes more stringent standards for hydrocarbons (HC) plus oxides of nitrogen (NOx) emissions, with a requirement that engines meet these emission standards through their useful lives.[7] Second, the proposal adds an in-use component to the Phase 1 compliance program to assure that the emission benefits are achieved in actual use.

As is clear from the analysis supporting this proposed rule (see Section V, VI and VII, and draft Regulatory Support Document), further emission reductions from future model year small SI engines beyond those achieved through the Phase 1 program can be achieved in a cost-effective manner. Uncontrolled, small SI engines contribute approximately 3.4 percent of the national HC emission inventory, 9.3 percent of the mobile source HC emission inventory, and 34.4 percent of the nonroad mobile source HC emission inventory.

The Phase 1 small SI regulations are expected to reduce the HC emissions from these engines by 32 percent. However, even with Phase 1 controls in place, small SI engines continue to contribute significantly to the emission inventory that leads to ozone concentrations in nonattainment areas. After Phase 1, small SI engines contribute approximately 3.1 percent HC nationally, 8.4 percent of mobile source HC, and 31.6 percent of the nonroad mobile source HC inventory (note that these values do not reflect changes in inventories from other sectors).

In addition, further control of HC+NOx emissions from future model year small SI engines beyond Phase 1 levels, as proposed in today's notice for Phase 2 controls, is achievable through technology that will be available for the engines to which the standards would apply, considering cost, lead time noise, energy and safety factors. For nonhandheld engines, proposed Phase 2 emission levels are expected to be achieved through a combination of modifications to current engine technologies, and conversions to cleaner, more durable technology such as overhead valve engine technology. For handheld engines, proposed Phase 2 emission levels are expected to be achieved through improvements to current 2-stroke engine technologies (see discussion in Section IV.A of this preamble).

If the Phase 2 program is adopted as proposed, many elements of the existing

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[7]EPA is proposing a set of values for the useful life of the engines for regulatory purposes. The term "useful life" refers to these regulatory useful life categories, which are discussed in more detail in Section IV.A.4 of this preamble.

Phase 1 program would remain essentially the same in the Phase 2 program. First, the types of engines covered by the proposed Phase 2 rule would remain essentially the same as those covered in the Phase 1 program (see discussion, Section IV.G). In addition, EPA would retain the five engine class categorization from Phase 1 for regulatory purposes as in Table 1 (see discussion, Section IV.G.3). Third, the Phase 1 criteria for determining whether an engine family would be allowed to certify to less stringent handheld standards would be retained (see Section IV.G.2).

Table 1: Small SI Engine Classes

Nonhandheld		Handheld		
Class I	Class II	Class III	Class IV	Class V
<225 cc	≥225 cc	<20 cc	20 cc≤ and <50 cc	≥50 cc

In addition, other elements of the existing Phase 1 program that would remain essentially unchanged in this proposed Phase 2 program include: 1) applicability of the rule and definitions (see 40 CFR Part 90, Subpart A), except as discussed in Section IV.G; 2) certification requirements (see 40 CFR Part 90, Subpart B), except for the proposed requirements to determine deterioration factors and to certify that engines meet the standards through their useful lives (see Section IV.D.1), and proposed flexibilities for small volume engine manufacturers (see Section IV.E); 3) provisions regarding test equipment and test procedures (see 40 CFR Part 90, Subparts D and E), except for minor changes addressed in Section IV.B; 4) provisions for selective enforcement audits (SEAs), (see 40 CFR Part 90, Subpart F), except that for the Phase 2 program SEA would exist primarily as a backstop to manufacturer-run production line testing program (see Section IV.D.2; and 5) provisions pertaining to importation of nonconforming engines, emission-related defect reporting requirements, voluntary emission recall program, exclusion and exemption of nonroad engines from regulations, prohibited acts and general enforcement provisions, and emission warranty and maintenance instructions (see 40 CFR Part 90, Subparts G, I, J, K, and L), except for provisions for ordered recall (see proposed §90.808) and compliance flexibilities for small volume equipment manufacturers (see proposed §90.1003). EPA solicits comment on the appropriateness of retaining these elements of the Phase 1 program in Phase 2.

Elements new to the regulatory requirements for small SI engines included in today's proposed Phase 2 program include: 1) proposed emission standard levels and useful life categories (see proposed amendments to Subpart B, and Section IV.A); 2) a certification averaging, banking and trading program for nonhandheld engines (see proposed Subpart C, and Section IV.A.5); 3) procedures for the determination of deterioration factors at the time of certification (see proposed amendments to Subpart B, and Section IV.D.1; 4) a manufacturer-run production line testing program, called CumSum, (see proposed Subpart H, and Section IV.D.2); and 5) in-use testing programs for nonhandheld and handheld engines, with an in-use credit program for handheld engines (see proposed Subparts M and N, and Section IV.D.3).

In addition, this proposal contains a number of flexibilities to ease the transition to this more stringent Phase 2 program, some which would apply to all manufacturers, and others which would be targeted to ease the transition specifically for small production volume manufacturers (see discussion, Section IV.E). Finally, today's notice also describes EPA's intent to pursue a voluntary "green labeling" program and a voluntary fuel spillage reduction program for nonhandheld and handheld engines, and a particulate matter (PM) and hazardous air pollutant testing program for handheld engines (see Section IV.F).

The programs proposed today for nonhandheld and handheld engines are similar in many respects. They also have some important differences. The intertwining issues of more stringent standards and assurance of emission reductions in use can be addressed in a number of ways. The remainder of this section provides an overview of the Phase 2 program goals of encouraging a shift to cleaner technology and assuring that emission reductions are achieved in-use, and a description of the basic proposed programs for nonhandheld and handheld engines for achieving these goals.

A. More Stringent Standards and a Shift to Cleaner Technology

EPA is proposing today HC+NOx emission standards for nonhandheld and handheld engines that are expected to achieve important reductions of emissions that contribute to ozone nonattainment. The standards for Classes II-V would be fully phased-in by the 2005 model year, with Class I levels effective in the 2001 model year. Engines would be required to meet these levels throughout their useful lives. For nonhandheld engines, a certification averaging, banking and trading program is proposed as an integral part of feasibility of the proposed HC+NOx emission standards (see Section IV.A.5). A more complete discussion of the justification of the level of the standards and the technologies expected to meet these levels can be found in Section IV.A. This section contains a brief overview of the proposed nonhandheld engine emission standards, the proposed handheld emission standards, and the proposal for useful life categories for nonhandheld and handheld engines.

1. Nonhandheld Engine HC+NOx Emission Standards

The emission standards proposed today for nonhandheld engines, indicated in Table 2, represent an approximate 25 percent reduction in HC+NOx levels from Phase 1 levels. These standards are expected to be achieved in a cost-effective manner by modifications to current engine technologies and, especially in the case of Class II engines, by conversion of current side valve (SV) technology engines to cleaner, more durable technology, such as overhead valve (OHV) technology engines. For Class I, where engine sales are currently dominated by side-valve (SV) technology engines, the proposed levels are expected to result in cleaner and more emissions durable SV technology engines, but are not in themselves expected to result in conversion of SV engines to OHV or comparably clean and durable engine technology. These modifications to SV engines can be accommodated by 2001, the proposed effective date

for the Phase 2 standard for Class I engines. For Class II engines, the proposed levels are expected to result in complete conversion to clean OHV or comparable technology. To allow this more significant design change, the proposed Phase II standards are gradually decreased from 2001 through 2005.

Table 2: HC+NOx Emission Standards for Nonhandheld Engines in Grams/Kilowatt-Hour (g/kW-hr)[8]

Engine Class	Model Year 2001	Model Year 2002	Model Year 2003	Model Year 2004	Model Year 2005
Class I	25.0	⇨	⇨	⇨	⇨
Class II	18.0	16.6	15.0	13.6	12.1[9]

A key aspect of the proposed Phase 2 program for nonhandheld engines is the belief that low emission standards for nonhandheld engines can be met through engine technology that can be low emitting both when the engine is new, and also when the engine has experienced hour accumulation to the engine's useful life. Therefore, these Phase 2 standards are based on useful life emission performance.

a. OHV and SV Engine Technologies

EPA believes that features inherent to the design of OHV technology engines are superior to those of SV engines and allow for lower new engine emissions as well as lower emission deterioration characteristics. In general, the combustion chamber and cylinder head design of OHV technology engines give these engines the potential to produce lower emissions both when new and also in-use. These engines have potential to exhibit lower emissions when new due to location of the combustion chamber directly over the piston, rather than partly to the side of the piston as in SV technology engines. This location allows a shorter combustion time, shorter flame propagation, better fuel combustion, and better cooling characteristics. In addition, OHV technology engines are designed with lower surface to volume ratios, which enhance fuel combustion. OHV technology engines also have the potential to exhibit improved in-use engine durability characteristics due to the location of the valves in the cylinder head rather than in the block, which affords more uniform exposure of the valves to heat sources and thus lower distortion of valves and valve seats. However, the Agency recognizes that the design of the engine is

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[8]Optional non-methane hydrocarbon (NMHC) plus NOx emission standards for natural gas fueled engines only, and carbon monoxide (CO) emission standards, are also proposed in today's notice, and are discussed in Section IV.A.

[9]The 12.1 g/kW-hr Class II standard assumes a phase-in from 50 percent in model year 2001 to 100 percent in model year 2005 of OHV or comparably clean and durable technology.

all-important, and that it is possible to improve features of both SV and OHV technology engines to enhance new and in-use emission characteristics (e.g., cylinder heads, advanced carburetion, fuel injection). The Agency requests comment on the fundamental supposition of this rule that OHV technology engines have the potential to be superior to SV technology engines for new and in-use emissions characteristics. Further discussion of SV and OHV technology engines is contained in Section IV.A and Chapter 3 of the Draft Regulatory Support Document (RSD).

b. Class I Use of OHV Technology

The nonhandheld small SI engine market has traditionally been dominated by SV technology engines, with SV technology engines accounting for as much as 90 percent of engine sales in Class I and 65 percent of engine sales in Class II. The majority of Class I SV engines are used in low cost, consumer products such as walk-behind mowers. Recently, the market has been moving towards OHV for Class II, in recognition of OHV advantages in engine performance, engine durability, fuel economy, and emissions characteristics. These advantages would be expected to be more important in commercial equipment which tend to make up significant market for Class II engines. For Class I engines, there has not been this same trend to OHV technology.

One barrier to increased penetration of OHV technology engines into the Class I market, which is dominated by residential, low cost equipment, may have been the cost associated with the conversion of product lines from SV technology to OHV technology. These conversion costs to the engine manufacturer are expected to be in the range of $5 to $14 per engine, depending on volume; cost to the consumer would likely be even higher (see Section VI for further discussion of these costs). For residential, low cost equipment, the OHV engine's advantages in performance and durability may not outweigh the associated higher purchase price when compared to equipment using less expensive SV equipment, at least in the near term and in light of the lead time EPA is proposing for the proposed Class I standard. If consumers of residential equipment are particularly price sensitive, they may choose not to purchase new equipment if priced higher due to the use of an OHV engine. Rather, to the extent four stroke SV engines tend to continue providing operable service, consumers may choose to spend money on equipment maintenance, extending both the life of the equipment and the number of hours the existing, non-Phase II SV engines would be used. If this happens, sales of cleaner, Phase II engines could be depressed and the extended use of SV engines toward the end of their useful life would add disproportionately to emission from small engines as the emission performance of these engines tends to continue deteriorating with use. Moreover, promulgation of a more stringent Class I standard, combined with the proposed Class II standard, would raise questions about the need for providing significantly longer lead time before the standards became effective. Additionally lead time might be necessary to allow manufacturers to invest the greater level of engineering and production resources necessary to convert both Class I and Class II engines to OHV technology for their entire product line as could be necessary for a nationwide program. This additional lead time could delay the environmental benefits of the program.

Due to uncertainties as to consumer acceptance of OHV engines in typical Class I equipment applications if required nationwide and how a more stringent Class I standard might effect lead time for the program as a whole and the resulting uncertainty of emissions benefit, the Agency is not at this time proposing Class I standards which would mandate the conversion of Class I engines to OHV technology. However, EPA is requesting comments on the likely impacts of such a standard. Even if it is not appropriate to adopt more stringent Class I standards now, in the future, as uncertainties regarding consumer acceptance of OHV Class I engines and other issues are resolved, EPA will be able to re-evaluate the stringency of the proposed standard and pursue any necessary and appropriate revisions. Additionally, the experience in California will likely provide useful information.

While today's proposed emission standards for Class I engines are not expected to require additional conversion from SV to OHV technology, EPA does desire to encourage the production and sale of OHV engines into the Class I market on a mass volume basis. In order to encourage this, EPA has entered into Memoranda of Understanding (MOUs) with two individual engine manufacturers.[10] These two companies currently represent over 80 percent of all Class I engine sales. The two MOUs detail the specifics of Class I OHV engine demonstration programs which are designed as experiments to explore the consumer acceptance and feasibility of developing low cost OHV technology which can be applied to mass production Class I engines. The two programs include a series of reports to EPA on the level of success, impediments encountered, market response, costs, emission rates, and so forth. The two Class I OHV demonstration programs will begin prior to the proposed effective dates for the Phase 2 rule. While the MOUs are outside the scope of the regulatory process, if successful, this voluntary program may generate considerable emission benefits in addition to those anticipated to result from the proposed standards.

In addition, the proposed voluntary "green labeling" program is designed to encourage manufacturers to produce engines that are substantially below the standards proposed today. In Class I in particular, manufacturers may decide for market reasons to convert current SV engines to OHV or comparably clean and durable technology engines, in order to qualify for the "green label" (see discussion of the program in Section IV.F.1).

EPA requests comment on the general issue of the impact of moving to OHV technology for class I engines, including the potential impact on sales of new equipment, the extended use of existing SV engines, the impact of a more stringent Class I standard on the ability of manufacturers to meet the proposed Class II standard under the proposed schedule, any options in addition to the voluntary "green labeling" program which would encourage the sale of clean OHV technology engines and the implications for emissions impact which would likely result from these actions.

c. Class II Use of OHV Technology

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[10]Copies of these MOUs are in EPA Air Docket A-96-55, Items II-B-03 and II-B-04.

The 12.1 g/kW-hr HC + NOx emission standard proposed to take effect in the 2005 model year for Class II engines is expected to result in complete conversion to clean OHV or comparably clean and durable engine technology. As is discussed below in Section IV.A, this is an aggressive standard for Class II engines. The transition to OHV technology should be eased by the phase-in of the standard and the certification averaging, banking, and trading provisions proposed today for nonhandheld engines.

2. Handheld Engine HC+NOx Emission Standards

The standards proposed today for handheld engines represent an approximate 35 percent reduction from Phase 1 levels, to be phased-in on a percentage of production basis between the 2002 and 2005 model year, as indicated in Table 3. These standards are expected to be achieved in a cost-effective manner by use of improved 2-stroke technology engines (as discussed in more detail in Section IV.A).

Table 3: HC+NOx Emission Standards for Handheld Engines (in g/kW-hr)

Engine Class	HC+NOx Emission Standard (g/kW-hr)	Model Year 2002	Model Year 2003	Model Year 2004	Model Year 2005
Class III	210	20%	40%	70%	100%[11]
Class IV	172				
Class V	116				

Two-stroke technology engines have traditionally been the dominant engine design used for handheld equipment applications. These engines have been well suited to meet the weight, multipositional use, and power requirements of these applications. However, 2-stroke technology engines also have very high engine emissions, compared with 4-stroke technologies, due in large part to fuel scavenging losses.

With the advent of emission control requirements federally and in California, research into other technologies to further control emissions from engines used in handheld applications has occurred. Promising technologies include light weight 4-stroke technology engines, and 2-stroke technology engines with aftertreatment. However, little is known about the in-use performance, in-use emissions characteristics and cost of these technologies, or how appropriate it is to consider these technologies across the full range of handheld equipment applications. Because of these uncertainties, today's standards

[11]The standards would be phased-in on the basis of percentage of total eligible sales. In this proposed rule, "eligible sales" or "U.S. sales" is defined as Phase 2 engines sold for purposes of being used in the United States, and includes any engine exported and subsequently imported in a new piece of equipment, but excludes any engine introduced into commerce, by itself or in a piece of equipment, for use in a state that has established its own emission requirements applicable to such engines pursuant to a waiver granted by EPA under section 209(e) of the Clean Air Act.

would not require conversion to 4-stroke engine technology or the use of aftertreatment for handheld engines. However, EPA wants to encourage introduction of technologies into today's market which are cleaner than required by the proposed standards. For example, EPA recognizes that some engine manufacturers have recently developed and marketed cleaner, lightweight 4-stroke engines for use in handheld equipment. The Agency believes potentially cleaner 4-stroke engines, 2-stroke engines with aftertreatment and other advanced two-stroke technologies may enter the market to a limited extent on a national level during the time frame of the Phase 2 program. EPA's goal is to encourage development of such technology, and EPA believes that the proposed "green labeling" program, (discussed in Section IV.F.1) should provide important incentives to manufacturers to introduce cleaner technologies on a national basis. In addition, the Agency intends to conduct a technology review and a possible Phase 3 rulemaking to address the possibility that technological advances and/or cost reductions may occur after promulgation of the Phase 2 rule that could make greater, but still cost-effective reductions feasible in handheld engine emission levels.

2. Useful Life Categories

Today's proposal would require that engines meet the proposed emission standards throughout their useful lives. EPA is today proposing multiple useful life categories, indicated in Tables 4 and 5, given the numerous applications in which these engines are used, and wide variation in expected engine useful life in these different applications. In addition, the use of these engines in applications which experience primarily commercial rather than primarily consumer or residential usage can also impact the useful life of the engine.

Table 4: Useful Life Categories for Nonhandheld Engines (hours)

	Category C	Category B	Category A
Class I	66	250	500
Class II	250	500	1000

Table 5: Useful Life Categories for Handheld Engines (hours)

	Residential	Commercial
Class III, IV and V	50	300

EPA is proposing that at the time of certification, engine manufacturers would have the responsibility to select the useful life period which most typically represents the in-use operating periods for the majority of engines in the engine family, based on information about that engine family including design and durability information, as well

as information about the equipment in which the engine is expected to be used. Manufacturers would label the engine according to the useful life selection. See Section IV.A.4 for further discussion of the proposed useful life provisions for nonhandheld and handheld engines.

B. Assuring Emission Reductions are Achieved In-use

The goal of the in-use component of the proposed Phase 2 program is to provide assurance that the emission reduction benefits anticipated by the program are achieved in actual use. This section describes how EPA's traditional compliance programs for mobile sources achieve this goal, outlines various challenges in designing a compliance program for the small SI industry, provides an overview of the compliance program proposed today for nonhandheld and handheld engines, and discusses alternative compliance program options.

1. Traditional Compliance Programs For Mobile Sources

EPA has traditionally used three-step compliance programs to implement and enforce mobile source emission standards. For a given engine family, the first of the three steps is certification, where, based on emission data from test engines, which are often prototype engines, EPA issues a license to the engine manufacturer known as a certificate of conformity. This license enables the manufacturer to introduce engines covered under the certificate into commerce in the United States. This step typically includes some means of projecting the emissions characteristics of the engine family over its useful life. If the manufacturer demonstrates according to the regulatory provisions that the engine family meets the emission standards for the useful life of the engines, EPA issues a certificate of conformity.

The second step is production line testing where the engine manufacturer demonstrates that actual production line engines meet emission standards. Production line testing provides an opportunity for EPA and the manufacturer to verify that designs approved based on certification testing are translated into mass production engines that meet standards and to catch production problems before they become in-use problems.

The last step involves the testing of in-use engines to ascertain whether the engines continue to meet standards during their useful lives in the hands of typical customers. EPA has the authority under Section 207(c) of the Clean Air Act to require a mandatory recall of vehicles or engines that have been shown not to comply with standards for their useful life. Such recalls are instigated based on evidence of nonconformities discovered through a variety of means, the most common of which are cases in which nonconformities are found either through production line testing or through in-use testing programs. In EPA's on-highway emission control programs, EPA's recall authority and recall practices have provided clear incentives to manufacturers to produce emissions durable engines and vehicles.

2. Compliance Programs for the Small SI Engine Industry

The Phase 1 emission control program for small SI engines does not follow this typical three-step compliance program. This is because, unlike other programs, the Phase 1 program includes "new engine" standards only, that is, standards that the engines must meet when new, without the requirement that they continue to meet those standards in-use throughout their useful lives. As such, while the Phase 1 program contains programs for certification and production line testing (in the form of EPA initiated Selective Enforcement Audits), the program does not contain a requirement for manufacturers to project the emissions characteristics of the engine family over its useful life at the time of certification (e.g., to determine a deterioration factor, or "df", for the engine family), nor does it contain mandatory in-use testing provisions. EPA promulgated such a program for Phase 1 for several reasons, including the belief that for a first phase of emission controls, significant emission reductions would occur in this sector even with the "new engine" standards. Equally important was the lack of data available to the Agency at the time of the rulemaking on which to base an in-use program (e.g., information supporting appropriate regulatory useful life periods and engine deterioration rates). In addition, EPA made clear its intention to address in-use issues in a second Phase of regulation.

In addition to determining appropriate useful life periods and engine emission deterioration characteristics for this proposed Phase 2 program, the Agency has also faced a key challenge of how to conduct an effective in-use testing program for these engines, and whether or not a recall program modeled on the traditional on-highway recall program could be an effective compliance tool for this sector of the nonroad engine industry. As EPA has begun to regulate a wide range of nonroad engines pursuant to Section 213 of the Clean Air Act, it has become evident that a mandatory recall program, as has been traditionally conducted for the on-highway industry, may not be the most effective program for some sectors of the nonroad engine industry, as compared with other means of assuring compliance in-use. This is especially true for the small SI engine industry, in which many of the engines are installed in consumer products which are not registered and thus would be difficult to track in the event of a recall, and in which the cost of conducting a potential recall could be large relative to the cost of the actual engines being recalled.

For certain nonroad engine industry sectors, such as the spark-ignition marine engine sector and the small SI engine sector, EPA has sought to develop alternative programs designed to provide reasonable means to address emissions exceedances identified through production line testing and in-use testing programs. For example, the spark-ignition marine engine program includes a voluntary in-use credit program that EPA expects will be an effective way to address exceedances identified through in-use testing, and the program also includes provisions for the use of certification credits to address exceedances identified through production line testing (see 40 CFR Part 91).

EPA believes that these alternative programs, designed to provide a means to address emission exceedances, should meet several criteria in order to be considered as effective as EPA's traditional mandatory recall programs. First, they should provide an incentive to manufacturers to build emission-durable engines. Second, they should be practical to implement. Third, they should provide an incentive to perform accurate testing. Fourth, such programs should offset additional emissions that occur as a result of

the exceedence of the standards. Finally, such programs should not be unduly burdensome to manufacturers.

The compliance programs proposed today for small SI nonhandheld and handheld engines are intended to meet these criteria. While EPA retains the authority to order a recall if a substantial number of engines are found to be in nonconformity, and while this Phase 2 proposal does include regulatory language governing EPA's action in ordering recalls (see proposed Subparts I and M), EPA anticipates considering programs which would be effective alternatives to ordering a mandatory recall of Phase 2 certified engines. Instead, EPA would expect these alternatives to recall would address the exceedances of the emission standards in ways that meet the five criteria identified above. For nonhandheld engines, in some cases, the use of certification credits would be allowed to offset exceedances of the family emission limit[12] in the event of PLT exceedances. For handheld engines, the use of in-use credits would be allowed as one means of addressing potential exceedances of standards in the event of exceedances determined through production line testing or in-use testing programs. For both nonhandheld and handheld engines, other possible alternatives for addressing exceedances of emissions standards would include voluntary recall and other possible alternative projects (these issues are discussed further in Section IV.D of this preamble).

3. The Proposed Phase 2 Compliance Program

Today's program proposes "in-use" standards for the first time for this industry.[13] New elements of the Phase 2 compliance program include processes for determining deterioration factors ("dfs") at the time of certification, a manufacturer-run Production Line Testing program, and in-use testing components.

i. Certification and In-Use Testing

Today's proposal includes three different approaches to certification df determination and in-use testing, based on engine class and engine technology, which are discussed briefly below. These approaches comprise the basic program proposed today.

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[12]For nonhandheld engines participating in the averaging, banking, and trading program described in more detail in Section IV.A.5, compliance would be demonstrated with the family emission limit, or FEL, rather that the standard.

[13]The fact that the proposed Phase 2 emissions standards are "in-use" standards, compared with the Phase 1 standards which are "new engine" standards, together with the fact that these engines do experience emissions deterioration over time, is why, when compared numerically with the Phase 1 levels, Phase 2 levels in fact are higher in the case of Class I. Despite this apparent numerical discrepancy, EPA still anticipates important reductions from all engine classes as a result of the proposed Phase 2 standards. Since Phase 2 designs will account for in-use deterioration, in-use emission levels will be lower under the proposed Phase 2 regulations compared to Phase 1 engines.

EPA is also proposing additional procedures for some engine classes and engine technologies to increase the flexibility of the rule.[14] All the approaches are discussed in more detail in Section IV.D.

First, for nonhandheld OHV technology engines, manufacturers would be allowed to apply an assigned deterioration factor or "assigned df" to new engine test values at the time of certification to determine a useful life certification value. Compared to an alternative of testing an engine over its full useful life to determine deterioration, these engines would be allowed to undergo this lower burden certification effort, in return for participation in an industry-wide OHV field durability and in-use emission performance demonstration program (as described in Sections IV.D.1 and IV.D.3). Second, for nonhandheld side-valve technology engines and engines with aftertreatment, manufacturers would certify their engines based on accumulating hours on the engines to the engines' full useful lives at the time of certification. This relatively heavier burden at the time of certification is balanced by a decreased in-use testing burden. Following full useful life certification, these engines would not be subject to further in-use testing requirements. Third, for all handheld engines, manufacturers would certify their engines to full useful life standards at the time of certification using new engine test values and dfs determined based on "good engineering judgment." Handheld engine manufacturers would then conduct an in-use testing program, by which each manufacturer would age and emissions test engines to ensure compliance in-use. A handheld engine manufacturer would in-use test up to 25 percent of its engine families each year.

Other than the addition of the requirements to demonstrate that engines meet the emission standards throughout their useful lives, and to determine a deterioration factor at the time of certification, the certification procedures proposed today for the Phase 2 program are essentially the same as those for Phase 1. In particular, EPA is proposing to retain a streamlined certification application form and process, with simple procedures for electronic submittal of information, as discussed further in Section IV.D.1.

ii. Production Line Compliance

Today's proposal would add a manufacturer-run Production Line Testing program known as CumSum to replace a Selective Enforcement Audit (SEA) program as the primary method of determining the compliance of new production engines. SEA would remain an optional or backstop program depending upon the class of engine, as described in Section IV.D.2.

iii. Aging Engines To Their Useful Lives

EPA believes that aging engines in field usage in typical representative applications would be the most accurate possible program for verifying in-use emissions.

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[14]For example, for nonhandheld OHV technology engines, manufacturers would have an option to use a "calculated df" rather than the "assigned df" described below.

As such, the proposed OHV field durability and in-use emissions performance program ("Field Durability Program") is designed to produce significant quantities of reliable test data from OHV engines aged in typical field usage, and to verify that the conclusions used in the certification process with respect to the durability of OHV engines are accurate.

While aging engines in typical field usage would be the optimal program for assuring the emission reductions are being achieved in use, EPA recognizes that costs associated with aging engines in the field and administering a field aging program could be higher than, for example, costs of a bench aging program. It is for this reason that EPA is proposing that for full useful life certification for nonhandheld side-valve technology engines or engines with aftertreatment, and for in-use testing for handheld engines, manufacturers may age engines on bench cycles, in lieu of field aging, provided that a field/bench adjustment factor has previously been established, as discussed in Section IV.C. EPA requests comment on the proposal to allow manufacturers in some cases to age engines on bench cycles in lieu of field aging.

In addition, for nonhandheld engine manufacturers, who could be field aging engines for the OHV Field Durability Program and also for the field/bench adjustment program, EPA is proposing a cap on the number of field engine tests required in a given year. EPA requests comments on all aspects of the compliance program proposed today for Phase 2 small SI engine regulation.

4. Alternative Compliance Program Options

The program proposed today for Phase 2 regulation of small SI engines is essentially the same as the program described in the ANPRM for this rulemaking. EPA received comments on the ANPRM relating to the differences between the nonhandheld and handheld sides of the industry, and the merits of applying concepts and programs outlined for one side of the industry to the other. One commenter stressed that the nonhandheld and handheld engine industries are very different in composition, in marketing, in technology, as well as in application. This commenter suggested that the program for nonhandheld engines described in the ANPRM is an integrated whole, with each provision linked to other provisions, and that it would be a mistake to graft parts of the handheld program on to the nonhandheld program. Another commenter suggested that the Agency should take a comprehensive and balanced view of the program for the two sides of the industry, and that elements of the two proposals should be used to create a simpler and more effective regulation.

EPA is concerned that any changes to the programs being proposed today should be considered carefully as to their impact on the program as a whole, given linkages between the various elements of the programs proposed today. For example, the compliance program proposed for nonhandheld OHV technology engines is designed as an integrated whole. The proposal to allow manufacturers to use the assigned dfs for certification is reasonable because it is linked to the proposal for an industry-wide OHV Field Durability Program designed to verify the assumptions with respect to stable and low dfs. In addition, EPA believes this conversion of engines to OHV or comparably

clean and durable technology, together with the OHV Field Durability Program, is one of the strongest elements of today's proposal, an element which links stringent standards forcing clean technology with a field testing program to verify that those emission reductions are being achieved in use.

However, EPA believes that there are multiple ways to design effective programs for reducing emissions from small SI engines, and for ensuring that those reductions are achieved in use. EPA requests comment on alternative compliance options. For example, EPA requests comment on an option which would allow nonhandheld manufacturers to establish certification dfs for SV engines and engines with aftertreatment through good engineering judgment (instead of the proposed program for full useful life aging for certification), linked to a program for field aging SV engines and engines with aftertreatment to verify the dfs established through good engineering judgment. EPA also requests comment on applying the in-use testing program proposed today for handheld engines to the nonhandheld side of the industry. EPA requests comments on these or other ways in which programs for the two sides of the industry could be designed to achieve the goals of providing assurance of environmental benefits in-use, easing the implementation burden for EPA and the industry, and achieving greater commonality in the programs for the two sides of the industry, where appropriate.

IV. Description of Proposed Program

Section IV of today's notice contains a description of the programs proposed for nonhandheld and handheld small SI engines for Phase 2 regulations, including discussion of standards and related provisions, test procedures, a field/bench adjustment program, compliance programs, flexibilities, nonregulatory programs, and other general provisions.

A. Standards and Related Provisions

This section provides a detailed discussion of the standards being proposed for the Phase 2 program, as well as related provisions including useful life categories, certification averaging, banking, and trading provisions, and certification fuel.

The Agency is aware of the levels which the California Air Resources Board (CARB) is considering for their Tier 2 standards for their Utility, Lawn, and Garden Engine regulation. The CARB Tier 2 levels are more stringent and occur in a shorter time frame than the levels being proposed by the Agency for a Federal Phase 2 program. Although EPA's approach is not structured identically with CARB regulations, EPA believes there are two valid reasons for the distinction. First, Congress has recognized the need for California to maintain its own mobile source emission control program (see section 209 of the CAA) because it faces difficult and distinct air pollution problems and, as a result, may need to adopt measures more stringent than those that apply in the nation as a whole (see, e.g., Motor & Equipment Manufacturers Association v. EPA, 627 F.2d 1095, 1110-11 (D.C. Cir. 1979)). Second, EPA's nonroad emission standards are not allowed to be more stringent than is achievable for this nationwide program after consideration of cost and lead time according to section 213(a)(3) of the CAA. Although

California is constrained by similar criteria per the authorization criteria of section 209(e), consideration of such criteria is limited to the State of California. The Agency must consider cost and lead time when nonroad emission regulations affect the nation as a whole. As discussed in the remainder of this section, the Agency believes the standards contained in today's proposal meet the section 213(a)(3) requirements to consider cost and lead time in setting Federal standards.

1. HC+NOx Emission Standards

The Agency believes the level of the standards contained in today's proposal would achieve the greatest degree of emission reduction achievable through application of technology which will be available and considering lead time under the proposed schedule of compliance, noise, energy, safety, and cost factors associated with applying such technology to a nationwide program. The sections below discuss how EPA addressed and weighed these factors in developing the proposed standards.

EPA is proposing in-use HC+NOx standards of 25 g/kW-hr effective in model year 2001 for Class I engines, and 12.1 g/kW-hr to be phased-in between model years 2001 and 2005 for Class II engines, as presented in Table 6. EPA expects that the Class II levels would result in a complete shift in engine technology from side-valve (SV) to cleaner overhead valve (OHV) or comparably clean and durable technology by 2005.

Table 6: HC+NOx Emission Standards for Nonhandheld Engines (in g/kW-hr)

Engine Class	Model Year 2001	Model Year 2002	Model Year 2003	Model Year 2004	Model Year 2005
Class I	25.0	⇨	⇨	⇨	⇨
Class II	18.0	16.6	15.0	13.6	12.1

EPA is proposing in-use HC+NOx emissions levels for Class III, IV and V engines to be phased-in between model years 2002 and 2005 based on a percentage of U.S. sales as presented in Table 7.

Table 7: HC+NOx Emission Standards for Handheld Engines (in g/kW-hr)

Engine Class	HC+NOx Emission Standard (g/kW-hr)	Model Year 2002	Model Year 2003	Model Year 2004	Model Year 2005
Class III	210	20%	40%	70%	100%
Class IV	172				
Class V	116				

Unlike the nonhandheld Phase 2 program, for handheld engines, the phase-in process of mandatory percentages would result in Phase 1 and Phase 2 handheld engines being produced in the same model year, i.e., at least 20 percent of the engines produced

in model year 2002 would be Phase 2 engines subject to the Phase 2 program, and up to 80 percent of the handheld engines produced in model year 2002 would be Phase 1 engines subject to the Phase 1 program, followed by a 40/60 split in model year 2003, and a 70/30 split between Phase 2/Phase 1 engines in model year 2004.

The remainder of this section describes the analysis and supporting data for the proposed HC+NOx standards for Class I nonhandheld engines, Class II nonhandheld engines, and Class III, IV, and V handheld engines. Each of these subsections is organized into the following topics: *(i) Historical Sales Trends by Engine Technology* - Historical trends are important to consider when assessing the range of field proven technologies. Historical trends assist in understanding what technologies have been demonstrated in actual use, what manufacturers' current production capabilities are, and the availability of new and in-use emission performance data; *(ii) In-use HC and NOx Emission Performance of Uncontrolled Engines* - The Agency presents this information to highlight the in-use performance characteristics associated with small engine technologies and the need for careful consideration of the in-use performance of various control technologies. Phase 1 new engine emission performance data is available from Federal certification data. However, in-use emission performance on engines pulled from the field is limited; therefore, a discussion of the in-use performance of uncontrolled engines is warranted; *(iii) New Engine and In-use HC and NOx Performance of Phase 1 Technology Engines* -A summary of the information available on the new and in-use emission performance of Phase 1 engines is presented. This information is used to assess the current status of the small engine industry, which is critical for the Agency's analysis when trying to predict the impact of technology changes on the industry; (iv) *Technologies Considered for Phase 2 HC+NOx Standards* - Discussion of the technologies the Agency considered when determining the level of the proposed standards is presented. This includes a discussion of new and in-use emission performance of each technology, and the per engine cost associated with each technology, and; *(v) Proposed Phase 2 HC+NOx Standard* - A discussion of the Phase 2 standards the Agency is proposing, including information on why the proposed standards are achievable, the proposed lead time, and a discussion and request for comment on more stringent standards (such as the CARB Tier 2 levels).

a. HC+NOx Emission Standard for Class I Nonhandheld Engines

This section presents information used by the Agency to determine the appropriate level for the proposed HC+NOx exhaust emission standards for nonhandheld Class I engines. A more detailed explanation of the engine technologies and costs described in this section is contained in the Draft Regulatory Support Document (RSD) for this proposal, a copy of which is available in the public docket for this rule.

i. Class I Historical Sales Trends by Engine Technology

Class I engine (<225 cc nonhandheld engines) sales have historically been dominated by low cost four-stroke side-valve engines. Two-stroke gasoline Class I

engines are currently less than 10 percent of annual sales and will continue to decline as a result of the Phase 1 emission standards, which effectively calls for their phase-out by 2003 due to their high HC emissions. Prior to 1986, OHV engines represented less than one percent of annual Class I engine sales. In the past decade OHV engines have begun to penetrate the Class I marketplace, but they have hovered between 10 and 15 percent of total U.S. sales for the past eight years.

ii. In-use HC and NOx Emission Performance of Uncontrolled Class I Engines

Unregulated Class I engines have demonstrated high new engine emission rates for HC and CO, and low levels of NOx, as well as poor in-use performance (large deterioration factors) for HC and CO, with little deterioration of new engine NOx values.[15] HC deterioration has been shown to be greater than two times the new engine value in as little as four years of engine use.

iii. New Engine and In-use HC and NOx Performance of Phase 1 Class I Technology Engines

Phase 1 engines have improved new engine emission performance over uncontrolled engines, and may have improved in-use performance. The Draft RSD for this proposal contains publicly available information on engine families from all engine classes certified to the Phase 1 program. This information shows both SV and OHV technology can meet the Phase 1 Class I new engine standard.

The Agency has recently examined information presented by several engine manufacturers concerning emissions deterioration from Phase 1 technology Class I side-valve and over-head valve engines.[16] A more detailed discussion of this data is presented in the Draft RSD. This information covers over 50 Class I engines field aged by manufacturers, with usage varying from 20 to 300 hours. Table 8 contains a summary of the HC+NOx deterioration factors resulting from an analysis of this data.

Table 8: Summary of In-use Deterioration of Phase 1 Technology Class I Engines

	Class I OHV	Class I SV
Estimated HC+NOx df at 66 Hours	1.35	1.87

Analysis of this information indicates Class I SV HC+NOx deterioration is higher than

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[15]See "Emission Tests of In-use Small Utility Engines" Southwest Research Institute, Sept. 1991, EPA Air Docket A-91-24, Item #II-A-8, and "Nonroad Engine and Vehicle Emission Study" U.S. EPA Report #21A-2001, Nov. 1991, EPA Air Docket A-91-24, Item #II-A-10.

[16] See "Tier 1 Deterioration Factors for Small Nonroad Engines", Sept. 1996, a report by Air Improvement Resources, available in EPA Air Docket A-96-55, Item #II-D-11.

Class I OHV engines. The lower new engine emission levels of Class I OHV over SVs combined with lower in-use deterioration results in better in-use emission performance for Class I OHV engines compared to Class I SV engines.

iv. Technologies Considered for Phase 2 Class I HC+NOx Standards

The Agency analyzed the emission performance and cost of several technologies which could be applied to Class I engines, including improvements to existing SV engines, conversion of existing SV engines to OHV technology, and the application of catalytic converters to existing SV and OHV engines. Four-stroke SV technology utilizes an engine configuration in which the intake and exhaust valves are located to one side of the combustion chamber (also called an L-head design), as compared to four-stroke OHV technology in which the intake and exhaust valves are located directly above the combustion chamber. Catalytic converters are add-on aftertreatment devices which operate by chemically reducing or oxidizing exhaust gases. The Draft RSD for this proposal contains additional information regarding these three technologies.

As discussed previously, the majority of Class I engines utilize SV technology. Table 8 shows that Class I SV technology have HC+NOx deteriorations on the order of 1.87 times new engine levels at 66 hours of use. Combining this with the Phase 1 certification level of 16.1 g/kW-hr HC+NOx indicates an in-use level of approximately 30 g/kW-hr HC+NOx. The Agency believes additional reductions can be achieved with improvements to existing Phase 1 SV engines. A more detailed discussion of these improvements is contained in the Draft RSD. A summary of the improvements are: lowering of new engine emission levels achieved through enleanment of intake air-fuel ratio; improvements to valve seat material which will lower in-use distortion, resulting in decreased valve leakage and deposit formation; improvements in cylinder ring design, which will result in better combustion chamber sealing and lower oil consumption and lower combustion chamber deposits; continued structural improvements to cylinder design to lower cylinder distortion inherent in side-valve configurations; and addition of valve stem seals to limit the creepage of oil into the combustion chamber. As presented in the Draft RSD, the Agency estimates the improvements to Class I SV engines would cost the manufacturer as much as $4 to $7 per engine, depending on the engine family volume. The Agency estimates changes would result in improvements to both new and in-use emission performance, combining for a 10 to 20 percent improvement in the in-use HC+NOx performance beyond Phase 1 designs.

As indicated by Table 8, Phase 1 OHV engines have better in-use performance compared to Phase 1 SV engines. A new engine level equal to the Phase 1 standard of 16.1 g/kW-hr combined with a HC+NOx df of 1.35 at 66 hours results in an in-use emission rate of 21.7 g/kW-hr. This level is well below the performance of Class I SV engines, therefore the Agency has considered the conversion of existing Class I SV to OHV engines in developing the proposed Phase 2 levels. Based on the Federal Phase 1 new engine certification data analyzed for this proposal, the average Class I OHV engine emits around 10.5 g/kW-hr. Based on the deterioration information presented in Table 8 and design improvements discussed elsewhere, the Agency estimates a well designed

nonhandheld OHV engine could have an HC+NOx deterioration factor of 1.3. Assuming a 10 percent compliance margin, these specific Class I OHV engines could achieve an average in-use emission level of around 15 g/kW-hr. However, it should be noted that only about 10 percent of current Class I engines are OHV designs. The performance of these specific engines may not be representative of what would occur if all Class I engines were converted to OHV technology.

Federal certification data indicates a small number of Class I engines have certified to the Federal Phase 1 standards using catalyst technology. Though it is technologically feasible to apply catalysts to both SV and OHV engines, the Agency has little information regarding in-use durability and emission performance of engines equipped with catalysts. As discussed previously, the in-use emission performance of small engines is a critical component of the analysis EPA has undertaken in the development of the Phase 2 proposal. The Agency's experience with on-highway catalyst technology has shown considerable in-use deterioration of catalysts can occur. In recent years several technical papers have been published regarding catalyst durability on small engines, however, these papers have relied on laboratory durability programs, such as aging catalysts on dynamometers[17]. The Agency is not aware of any actual field-aged in-use catalyst durability information. The Agency requests comment on the relationship between laboratory durability data and in-use field data, any information on typical in-use aged catalyst performance, and all available data on individual catalysts aged under typical in-use conditions experienced by equipment using Class I engines. The Agency requests additional information regarding new engine emission performance, in-use emission performance, and cost of catalyst technology for Class I SV and OHV engines.

v. Proposed Phase 2 Class I HC+NOx Standard

The Agency is proposing a corporate average exhaust emission level of 25 g/kW-hr HC+NOx for Class I engines beginning in model year 2001 (for discussion of the averaging, banking, and trading program, see Section IV.A.5). The Agency believes this level is technologically achievable, and, as discussed previously, can be met by improvements to existing Class I SV engines. The Agency has performed an analysis using the existing Phase 1 certification data (which contains confidential sales projections) combined with reasonable assumptions for in-use deterioration. This analysis indicates an averaging standard of 25 g/kW-hr is achievable with improvements to existing SV engines and considering the emission performance of existing Phase 1 OHV engines. A standard of 25 g/kW-hr would not require an increase in the penetration of Class I OHV sales. Manufacturers would need to make improvements to existing SV engine families which would require improvements to several engine components. However, major retooling of engine production lines would not be required. In addition,

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[17]See Society of Automotive Engineers Technical Papers 930076, 932445, 941807, and 961735 for bench aged catalyst information.

the use of ABT provides manufacturers with considerable flexibility for determining the most appropriate expenditure of resources when deciding which engine families will need specific improvements to meet the proposed levels. The lead time between the finalization of this rule and model year 2001 would be sufficient for manufacturers to meet the proposed HC+NOx level.

The Agency has considered emission standard levels more stringent than the proposed 25 g/kW-hr HC+NOx. As discussed above, a level more stringent than 25 g/kW-hr could be met by the conversion of existing SV technology engines to OHV technology. The Agency's analysis of existing Phase 1 certification data combined with confidential sales information indicates an in-use level of around 15 g/kW-hr could be met by current Phase 1 Class I OHV engines with some design improvements to assure in-use emissions durability. However, these Class I OHV engines represent only about 10 percent of Class I sales; it is uncertain what level of emission could be achieved by complete conversion to OHV technology. As discussed previously, the percentage of Class I OHV engine sales has remained fairly constant for the past eight years, despite superior durability, performance, and fuel economy. Several Class I engine manufacturers, including the two largest which represent the majority of the market in terms of sales, have discussed with the Agency their past attempts to sell low cost OHV engines, likely in competition with less expensive SV engines. Manufacturers have indicated they have seen little success in drawing consumers away from the even lower cost Class I SV engines. Engine manufacturers have indicated that the principle reason for the failure of OHVs to penetrate further into the Class I market is the cost difference between the two engine technologies, and consumers' unwillingness to pay this premium. Several engine manufacturers have indicated that low cost Phase 1 Class I SV engines have manufacturing costs on the order of $60 to $70 per engine. Engine manufacturers contend that for these low cost engines, the cost increase to purchase an OHV engine is large enough to prevent a larger market penetration by OHV engine, at least when they would have to compete in the market with SV engines (see 62 FR 14752, "Class I OHV Demonstration Program"). The Agency estimates the manufacturer's cost for conversion to OHV to be between $5 and $14 per engine. Engine manufacturers have indicated concern over what they perceive to be the potentially dramatic impacts on the Class I engine sales which would result from a standard which requires conversion to OHV technology. As discussed in the Overview Section III.A, above, EPA is also concerned that possible adverse impact on sales and the potential need for additional lead time could result in reduction in at least the near term emission benefits anticipated by this proposal. The Agency requests comment on the market concerns expressed by engine manufacturers, on the potential impact on lead time associated with a more stringent Class I standards and on the potential for delay in at least the near term emission reduction benefits available from Class I engines if more stringent standards were adopted.

The Agency is aware of the emission standards being considered by CARB for the CARB Tier 2 Utility, Lawn, and Garden Engine (ULGE) regulation. The Agency's current understanding is that CARB is considering Class I engine in-use standards of 16.1g/kW-hr NMHC+NOx to be met by model year 2000, followed by a standard of

12.0g/kW-hr in model year 2004. In their comments to the ANPRM, California recommended a nationwide level of control equivalent to that being considered by CARB. Further, CARB suggested these standards could be met with the use of available technology, specifically, total conversion to OHV technology to achieve compliance with a 16.1 g/kW-hr NMHC+NOx standard and the addition of catalyst control to meet a 12.0 g/kW-hr NMHC+NOx standard. EPA understands that CARB is still evaluating its Tier 2 ULGE program and may adopt regulations which differ from these specific levels or implementation dates or both. As discussed under Section IV.A of this proposal, section 209 of the CAA allows California to set its own standards, considering criteria as they apply to the State of California. However, as discussed later in this section, the Agency requests comment on whether application of these emission control technologies as being considered by CARB are appropriate for a Federal program at this time, the level of emission control expected from such application of these technologies and what adjustments to the proposed Federal program might be necessary to accommodate standards which would require such widespread application of OHV and catalyst technology.

The Agency has considered the potential impacts associated with the conversion of Class I SVs to OHV technology. Due to uncertainties as to consumer acceptance of OHV engines in typical Class I equipment applications and as to how a more stringent Class I standard might effect lead time for the program as a whole and the resulting uncertainty of emissions benefits, the Agency has chosen not to propose Class I standards which would mandate the conversion of Class I engines to OHV or comparably clean technology. However, the Agency requests comment on such an option. EPA specifically requests additional supporting information regarding this issue to be made available to the Agency through the public comment process on this proposed rule to supplement that which informed EPA's analysis of CARB's proposed Tier 2 levels and EPA's cost estimates of converting Class I engines to OHV. The Agency requests comment on all aspects of the proposed Class I standards.

b. HC+NOx Emission Standard for Class II Nonhandheld Engines

This section presents information used by the Agency to determine the appropriate level for the proposed HC+NOx exhaust emission standards for nonhandheld Class II engines. A more detailed explanation of the engine technologies and costs described in this section is contained in the Draft RSD for this proposal, a copy of which is available in the public docket.

i. Class II Historical Sales Trends by Engine Technology

Class II engine sales have been dominated by 4-stroke SV engines in the past. As described in the Draft RSD, Class II engines were predominantly SV technology in the 1970's and early 1980's. Beginning in about 1985, OHV engines have steadily increased their annual sales penetration into the Class II market, averaging about a 3 percent increase per year; by 1995 OHV engine sales represented approximately 35 percent of

the Class II market, with the remaining 65 percent being SV engines.

ii. In-use HC and NOx Emission Performance of Uncontrolled Class II Engines

Information regarding new engine and in-use emission performance of uncontrolled Class II engines is limited. While some new engine data is available, the Agency does not have in-use emission information on uncontrolled Class II engines. The limited new engine information from uncontrolled engines comes from the CARB Technical Support Document for the CARB ULGE program.[18] The Agency used this information to estimate the new engine emission factors for the 1991 Nonroad Engine and Vehicle Emission Report. Those estimates were between 15.2 and 15.4 g/kW-hr for typical new engine Class II HC+NOx emission factors.

iii. New Engine and In-use HC and NOx Performance of Phase 1 Class II Technology Engines

Table 9 is a summary of the new engine emission values for gasoline fueled SV and OHV engine families certified to the Federal Phase 1 regulations as of September 1997.

Table 9: Summary of Federal Phase 1 Class II Gasoline Fueled Engine Families

Technology	Number of Families	Average New HC+NOx (g/kW-hr)	Minimum New HC+NOx (g/kW-hr)	Maximum New HC+NOx (g/kW-hr)
Federal Phase 1 OHV	64	9.0	5.3	12.9
Federal Phase 1 SV	14	11.3	9.4	12.9

The values in Table 9 are an average of the certified new engine rates. EPA has access to manufacturers' confidential sales estimates for model year 1997. Using these projections the sales weighted new engine HC+NOx emission rate is 11.7g/kW-hr for Class II SV engines, and 8.3g/kW-hr for Class II OHV. This certification data shows that OHV new engine HC+NOx emissions tend to be lower than SV emissions.

In 1996 the Agency received a report from several engine manufacturers regarding the deterioration of Phase 1 technology Class II SV and OHV engines.[19] A more detailed discussion of this information is contained in the Draft RSD for this proposal. Table 10 contains a summary of this information.

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[18]California Air Resources Board Mail Out #92-06, Technical Support Document for California Exhaust Emission Standards and Test Procedure for 1994 and Subsequent Model Year Utility and Lawn and Garden Equipment Engines, January 1992.

[19]"Tier 1 Deterioration Factors for Small Nonroad Engines" September 1996, a report by Air Improvement Resources, available in EPA Air Docket A-96-55, Item #II-D-11.

Table 10: Summary of In-Use Deterioration Factors for Phase 1 Class II Engines		
	Class II OHV	Class II SV
Estimated HC+NOx df 250 hours	1.4	1.6

iv. Technologies Considered for Phase 2 Class II HC+NOx Standards

The Agency analyzed the emission performance and cost of several technologies which could be applied to Class II engines, including improvements to existing SV engines, conversion of existing SV engines to OHV technology, improvements to existing OHV engines, and the application of catalytic converters to existing SV and OHV engines. The Draft RSD for this proposal contains additional information regarding these technologies.

The Agency considered the costs and emission performance potential which would result from manufacturers making improvements to Phase 1 Class II SV engines. As discussed in the Draft RSD, several areas for improvement potentially exist, including: improvements to carburetors to lower variability and maintain more precise air/fuel control; enhancements to the cylinder structural integrity; improvements to valve stems and valve seats; and changes in piston ring design. These improvements would lower production variability and improve both new engine and in-use emission performance. The Agency estimates these changes would cost the manufacturer as much as $7 to $20 dollars per engine depending on engine family volume and the improvements required. However, the Agency believes the improvement in the in-use emission performance from Phase 1 levels would be small. All spark-ignited engines have a lean performance limit, i.e., an air/fuel ratio beyond which additional enleanment will result in unstable combustion and poor engine performance. The basic design of the SV combustion chamber results in a lean performance limit which is reached relatively soon (compared to OHV technology). Improvements in the in-use performance can be made, but the Agency believes these improvements will also be relatively small. The Agency estimates that the improvements to SV technology considered would result in an overall 10 to 20 percent reduction in the in-use emissions from Phase 1 SV levels. With the Phase 1 Class II new engine standard equal to 13.4 g/kW-hr HC+NOx, and a Phase 1 Class II SV df of 1.6, the Phase 1 in-use emission rate is 20.1g/kW-hr at 250 hours. A 10 to 20 percent reduction translates to an in-use emission rate between 16.8 and 18.9 g/kW-hr.

As described above in Section IV.A.1.a, the principle difference between SV and OHV engines is the location of the intake and exhaust valves with respect to the combustion chamber; in SV engines the valves are located to one side of the combustion chamber, while in OHV the valves are located at the top of the combustion chamber directly above the piston. The OHV location offers many performance advantages over the SV engine, including lower valve seat distortion, lower combustion chamber surface-to-volume ratio, and the ability to run stably at leaner air-fuel ratios. These differences

are described in more detail in the Draft RSD. These differences can result in better new engine and in-use HC+NOx emission performance for OHV over SV technology. Based on confidential Phase 1 Class II OHV Federally certified engine families sales projections, the Agency believes an average new engine emission rate of 9.3 g/kW-hr, which includes a 10 percent compliance margin, is achievable from OHV technology engines. This would result in an in-use emission level of 12.1 g/kW-hr (1.3 * 9.3 g/kW-hr), which is a 42 percent reduction from Phase 1 SV levels (Phase 1 SV = 13.4 g/kW-hr * 1.6 = 20.1 g/kW-hr). As presented in the Draft RSD, the Agency estimates the conversion of Class II SV to OHV technology would cost the manufacturer between $10 and $17 per engine, depending on the engine family volume. Engine manufacturers have indicated the higher cost associated with conversion of Class II SV to Class II OHV technology is reasonable because the equipment using Class II engines is typically more expensive than the equipment targeted toward the residential market, and the increased cost resulting from conversion to OHV design would not have a significant adverse impact Class II engine sales. While EPA has no independent information on consumer price sensitivity for equipment using Class I engines, it is understandable that the higher price of this equipment and the typical commercial use of such equipment could allow the performance, fuel efficiency, and durability benefits of Class II OHV engines to outweigh the incremental impact on equipment price.

The Agency also considered improvements to existing Phase 1 OHV engines in determining the appropriate level of the Class II standard. In many cases, engine manufacturers have already optimized new engine emission performance and have incorporated improvements to engine designs to optimize in-use emission performance. However, as discussed in the Draft RSD, the Agency believes that for some Class II OHV engine families internal engine improvements can still be made which would result in lower new engine and/or better in-use performance. These changes include leaner carburetor calibrations to lower new engine HC+NOx, optimization of combustion chamber design, and improvements to oil control. As discussed previously, the sales weighted new engine Phase 1 Class II OHV HC+NOx level is 8.3g/kW-hr, and as shown in Table 10, the Class II HC+NOx df is estimated to be 1.4 at 250 hours. The Agency believes changes to existing Class II OHV engines will primarily improve in-use emission performance. As presented in the Draft RSD, the Agency estimates these changes would cost the manufacturer as much as $3 to $8 per engine, depending on the engine family production volume and the improvements required. However, the Agency believes many engine families have already incorporated these design improvements. Based on existing Federal certification data and the deterioration information contained in Table 10, the Agency estimates these improvements will result in an in-use HC+NOx deterioration rate of 1.3 at 250 hours, and average new engine emission rates (including a ten percent compliance margin) of 9.3 g/kW-hr, for an average in-use emission rate of 12.1 g/kW-hr.

Federal certification data indicates a small number of Class II SV and OHV engines families have certified to the Federal Phase 1 standards using catalyst technology. However, the majority of these engines are intended for indoor use on applications such as generators or floor buffers, where lowering CO emissions appears to be the primary focus. The majority of these catalyst equipped Class II engine families operate on

propane fuel. No catalyst equipped Class II engine families have certified to the Phase 1 rule for use in lawn and garden equipment. Though it is technologically feasible to apply catalysts to both SV and OHV engines, the Agency has little information regarding in-use emission performance of engines equipped with catalysts. The Agency's experience with on-highway catalyst technology has shown that considerable in-use deterioration can occur. As previously discussed in the Class I standard section, information on laboratory aged small engine catalysts has appeared in recent years in the technical journals. The Agency requests comment on the relationship between laboratory and field aged catalyst durability data, any information on typical in-use aged catalyst performance and all available data on individual catalysts aged under typical in-use conditions experienced by equipment using Class II engines. The Agency requests additional information regarding the new engine emission performance, in-use emission performance, and cost of catalyst technology for Class II engines, particularly Class II engines designed for lawn and garden type applications.

v. Proposed Phase 2 Class II HC+NOx Standard

The Agency is proposing a corporate average HC+NOx emission standard of 12.1 g/kW-hr which will be phased in over five years, beginning in model year 2001. Based on the information presented in this section, the Agency believes an in-use level of 12.1g/kW-hr can be met by the conversion of Phase 1 SV engines to OHV technology, and by internal improvements to some existing Phase 1 OHV engines.

The proposed standards would require significant production line changes for many Class II engine manufacturers to convert existing SV models to OHV designs, as well as modifications to some Phase 1 OHV models which may need internal improvements to meet the 12.1 g/kW-hr level. To accommodate a smooth transition of existing SV engine family production lines to the new OHV technology or other comparably clean technology, the Agency is proposing a five year phase-in period, starting with a level of 18 g/kW-hr in 2001 and ramping down to the final year level of 12.1 in model year 2005. The Agency expects the proposed standards for Class II engines would result in increased penetration of and virtual total conversion to clean OHV technology by 2005. However, the proposal does not preclude other technologies from meeting the proposed standard.

The Agency recognizes that there are large differences in technology mixes currently being produced by Class II engine manufacturers. Some Class II engine manufacturers have already made significant investments in OHV technology prior to and during the Phase 1 program. For some of these manufacturers the standards in the early years of the Phase 2 phase-in (i.e., the 2001 standard of 18g/kW-hr and the 2002 standard is 16.6 g/kW-hr) may not require additional reductions in Class II engine emissions. At the same time, the Phase 1 standards do not require a shift to clean, durable OHV technology or comparably clean technology, and several Class II engine manufacturers currently produce a significant number of SV engines. For manufacturers who are relying on SV technology the proposed phase-in period will allow them to shift their production to new, cleaner technology which is capable of meeting the 2005

standard of 12.1g/kW-hr. The Agency believes the phase-in standards will address the inequities among manufacturers' current technology mixes but will also require manufacturers to produce the clean, durable 12.1g/kW-hr engines in 2005. Manufacturers have indicated the early banking provision will pull ahead clean technology and ease the transition to the 12.1 standard. However, due to the wide discrepancy between manufacturers' current technology mixes, some manufacturers may generate significant credits during the phase-in period. The Agency has recently performed an analysis, based on Federal Phase 1 certification data, which indicates under some conditions, early banking would result in significant credits being generated during the phase-in period which may in fact undermine the Agency's assumptions that the 12.1 standard in model year 2005 would require a virtual 100 percent shift to OHV or comparably clear technology for Class II engines. To insure the EPA's goals are met, the Agency is proposing a declining set of caps on how high the sales-weighed average level of HC+NOx family emission limits (FELs) could be for Class II engine families beginning in 2005. A discussion of this proposal is contained in Section IV.A.5.

Engine manufacturers have commented that, while 12.1 g/kW-hr HC+NOx can be met with engines designed for a typical 250-hour useful life, engines designed for the longer proposed useful life categories of 500 and 1000 hours need a higher standard due to their higher expected df as measured over these longer hour periods.[20] Specifically, they recommend a 500-hour engine standard of 13.0 g/kW-hr and a 1000-hour standard of 14.0 g/kW-hr HC+NOx. In arriving at these recommendations, the manufacturers assumed the new engine emission levels would be the same regardless of useful life category; this is also assumed by the Agency in developing its proposal. However, while the manufacturers also predict improvements in in-use emission durability, they do not expect these improvements would allow a constant deterioration factor (full useful life emission level divided by new engine emission level) regardless of useful life category. Rather, the manufacturers expect improved durability would allow typical deterioration factors of around 1.4 for 500-hour engines and 1.5 for 1000-hour engines. In making these recommendations, the manufacturers acknowledge that they have not provided any data or analyses to validate their recommendations, but also argue that the Agency has no full useful life data for these higher hour categories which substantiate the feasibility of the Agency's proposed standards. EPA requests any additional data and other pertinent information which would help the Agency reassess the appropriate level of standards for the 500-hour and 1000-hour engines.

Based on the May, 1997 CARB Workshop on their Tier 2 standards, the Agency believes CARB may propose a Tier 2 in-use standard of 12.0 g/kW-hr NMHC+NOx in model year 2000, followed by a level of 9.4 g/kW-hr NMHC+NOx in model year 2004. CARB's 12.0 level may be achievable with OHV technology and is very similar to the Agency's proposed Phase 2 level. CARB's 9.4 g/kW-hr level is more stringent than the

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[20]See the discussion in the March 27, 1997 ANPRM, 62 FR 14740, and the Memo to the Docket regarding the October 3, 1997 meeting between U.S. EPA and the Engine manufacturers Association, EPA Air Docket A-96-55, Item #II-E-11.

Agency's 12.1 g/kW-hr proposal. CARB suggests an in-use 9.4g/kW-hr standard would require technology beyond conversion to OHV, such as an OHV engine equipped with a catalyst. The Agency believes the costs and lead time which could be necessary to achieve a 9.4 g/kW-hr level for a national program would be considerably greater than the program contained in today's proposal. However, as discussed under Section IV.A of this proposal, section 209 of the CAA allows California to set their own standards, considering criteria as they apply to the State of California. However, as discussed below, the Agency requests comment on whether the application of the technology anticipated by the standards being considered by CARB would be appropriate for a Federal program at this time.

The Agency requests comment on all aspects of the proposed Class II standards, and especially requests data, analyses and other information on the expected emission performance capability of Class II engines designed for in-use operating lives of 500 hours and 1000 hours.

c. HC+NOx Emission Standards for Class III, IV and V Handheld Engines

This section presents information used by the Agency to determine the appropriate level for the proposed HC+NOx exhaust emission standards for handheld engines (engine Class III, IV and V). A more detailed explanation of the engine technologies and costs described in this section is contained in the Draft RSD for this proposal, a copy of which is available in the public docket for this rule.

i. Class III, IV and V Historical Sales Trends by Engine Technology

Handheld engine sales have historically been dominated by crankcase charge scavenged two-stroke engines ("traditional 2-strokes"). Historical sales data indicate that until the recent introduction by one manufacturer, Ryobi, of a 4-stroke trimmer, 100 percent of gasoline engine powered handheld equipment used traditional 2-stroke engines.

ii. In-use HC and NOx Emission Performance of Uncontrolled Class III, IV and V Engines

Information on uncontrolled 2-stroke engines is limited. However, what information is available indicates 2-stroke technology has the potential to experience high rates of in-use deterioration of HC, on the order of two times the new engine value.[21]

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[21]See "Emission Tests of In-use Small Utility Engines" Southwest Research Institute, September 1991, EPA Air Docket A-91-24, Item #II-A-8, "Nonroad Engine and Vehicle Emission Study" U.S. EPA Report #21A-2001, November 1991, EPA Air Docket A-91-24, Item #II-A-10, "Emission Testing of In-use Handheld Engines" Southwest Research Institute, March 1994, EPA Air Docket A-93-25, Item #II-A-06, and "Regulatory Impact Analysis and

This same information indicated that little in-use deterioration of NOx emissions occur from traditional 2-stroke engines.

iii. New Engine and In-use HC and NOx Performance of Class III, IV and V Phase 1 Technology Engines

Federal Phase 1 certification data shows that over 150 two-stroke engine families have been certified for the 1997 and 1998 model years. A summary of the emission performance of these Phase 1 technology engine families is shown in Table 11.

Table 11: Summary of Federal Phase 1 Handheld 2-stroke Engine Families

Engine Class	Number of Families	Average New HC+NOx (g/kW-hr)	Minimum New HC+NOx (g/kW-hr)	Maximum New HC+NOx (g/kW-hr)
Class III	4	216	177	258
Class IV	131	189	97	236
Class V	19	136	90	161

The average emission rates for the Phase 1 Class III, IV and V traditional 2-stroke engines are 28 percent, 23 percent and 18 percent below the combined Phase 1 HC and NOx standards. Federal certification data also show three Class IV four-stroke technology engine families and three Class IV two-stroke with catalysts engine families have been certified to the Federal rule. The average HC+NOx certification levels for these engine families are 27 and 165 g/kW-hr respectively.

Information on in-use emission performance of Phase 1 technology 2-strokes is also limited. In preparation for the Phase 1 regulation, several members of the Portable Power Equipment Manufacturers Association (PPEMA) ran a test program which included manufacturer controlled field testing of seven Phase 1 technology 2-stroke engines, six aged to 50 hours, and one to 225 hours.[22] This data shows relatively low deterioration in HC+NOx emissions, with dfs ranging from slightly less than 1.0 to approximately 1.2 at 50 hours, and slightly less than 1.0 for the 225 hour engine.

The Agency has little information on the in-use performance of 4-stroke handheld technology or on handheld catalyst technology.

iv. Technologies Considered for Phase 2 Class III, IV and V HC+NOx Standards

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Regulatory Support Document, Control of Air Pollution, Emission Standards for New Nonroad Spark-Ignition Engines at or Below 19 kilowatts" U.S. EPA, May 1995, EPA Air Docket A-93-25, Item #V-B-01.

[22]See Appendix C of "Regulatory Support Document, Control of Air Pollution, Emission Standards for New Nonroad Spark-Ignition Engines at or Below 19 kilowatts" U.S. EPA, May 1995, EPA Air Docket A-93-25, Item #V-B-01.

The Agency analyzed the emission performance and cost of several technologies which could be applied to handheld engines. These include improvements to existing 2-stroke engines, conversion of existing 2-stroke engines to 4-stroke technology, and the application of catalytic converters to existing 2-stroke engines. The Draft RSD for this proposal contains additional information regarding these technologies.

For Phase 1 2-stroke technology engines, fuel lost during the scavenging process represents the largest fraction of exhaust HC emissions, and HC emissions represent greater than 95 percent of the exhaust HC+NOx emissions. The Agency believes several types of improvements can be made to Phase 1 technology 2-stroke engines. The following is a summary of potential areas for lowering HC+NOx emissions: 1) improvements in carburetors to reduce production variability and tighter air/fuel ratio control; 2) redesign of the combustion chamber to promote more complete combustion; 3) optimizing port shapes and timing to reduce scavenging losses; 4) leaner carburetor calibrations to reduce HC emissions; and 5) tighter manufacturing tolerances for engine components to reduce component variation. These improvements are discussed in more detail in the Draft RSD. As described in the Draft RSD, the Agency estimates the cost of these improvements would cost the manufacturer as much as $2 to $6 per engine, depending on the production volume of the engine family and the improvements required. The Agency would expect these changes to lower the new and in-use emission rates of Phase 1 two-stroke technology engines. PPEMA members have indicated they believe a well designed, properly maintained 2-stroke engine is capable of performing with no in-use deterioration of HC+NOx emissions. Based on the small amount of in-use data from Phase 1 technology engines, the Agency estimates the in-use performance of an improved Phase 1 technology 2-stroke engine would deteriorate approximately 10 percent during its useful life. The Agency estimates that for the majority of handheld engines, improvements to Phase 1 2-stroke designs would result in a 30 percent reduction in the in-use emission rates from Phase 1 designs.

The Agency also analyzed the benefits and associated costs which would occur from the conversion of existing 2-stroke handheld engines to 4-stroke designs. Two engine manufacturers, Ryobi and Honda, have successfully demonstrated that 4-stroke designs are viable in at least some handheld equipment applications, notably a string trimmer application. However, the Agency is uncertain that 4-stroke technology would be viable in all handheld applications, particularly those applications which require high power and low weight, such as large, commercial chainsaw applications, where the lower power-to-weight ratio of 4-stroke engines may impede equipment performance. Four-stroke technology does not have the scavenging loss problem associated with traditional 2-strokes. Therefore 4-stroke exhaust HC emissions are substantially below those of a 2-stroke design. Federal Phase 1 certification data for Class IV engines indicates a 4-stroke string trimmer produces new engine HC+NOx emission rates of about 27 g/kW-hr, which is approximately 80 percent below the Phase 1 standard. Deterioration information on small displacement 4-stroke engines is limited, and the Agency has no deterioration information on handheld 4-stroke engines. The Agency has heard from one small engine manufacturer that the smaller 4-stroke engines would likely have higher deterioration

than Class I OHV 4-stroke engines, which is on the order of 1.4 at 66 hours.[23] The Agency requests comment and additional information on the deterioration of smaller 4-stroke engines. As described in the Draft RSD, the Agency estimates the cost of converting an existing handheld 2-stroke to a 4-stroke engine would cost the manufacturer between $7 and $10 per engine, depending on the production volume of the engine family.

The Agency also considered the application of catalytic convertors to Phase 1 2-stroke technology. One handheld engine manufacturer, Husquvarna, has certified three engine families to the Phase 1 rule which utilize a 2-stroke engine with catalyst. This engine has been designed for lower scavenging losses to reduce engine out emissions, has improved fuel metering, and also uses a catalyst to further reduce exhaust emissions. EPA's testing of this engine showed new engine emission results for HC+NOx at the nominal carburetor setting on the order of 90 g/kW-hr, which is 63 percent below the combined Phase 1 Class IV HC+NOx new engine standard. The Agency does not have information regarding the actual in-use performance of this or other catalyst equipped 2-stroke engines. The Agency estimates the cost of adding a catalytic convertor to an improved 2-stroke handheld engine would cost the manufacturer between $6 and $12 per engine, depending on the production volume of the family. This cost estimate does not include any of the additional improvements to the Phase 1 technology 2-stroke mentioned previously, such as combustion chamber improvements or scavenging design improvements. As previously discussed, such improvements to existing 2-stroke designs would cost the manufacturer an additional $2 to $6 per engine. Therefore, the Agency estimates an improved 2-stroke design with a catalytic convertor would cost the manufacturer from $8 to $18 per engine. Comments are requested on these cost estimates.

v. Class III, IV and V Proposed Phase 2 HC+NOx Standard

The Agency is proposing an in-use HC+NOx standard of 210, 172 and 116 g/kW-hr for Class III, IV and V engines, respectively. As presented in Table 7, the proposed standards would begin in model year 2002, with a requirement that 20 percent of a manufacturer's U.S. sales meet the standards, followed by an increased percentage each year until model year 2005, when 100 percent of a manufacturer's U.S. sales would be required to meet the proposed standards.

The Agency expects the proposed in-use standards can be met primarily through improvements to existing Phase 1 technology 2-stroke engines. As presented previously, the Agency believes improvements to Phase 1 technology 2-stroke engines should result in approximately a 30 percent reduction in the in-use emissions of Phase 1 engines, which would be required to meet the proposed standards.

PPEMA members have indicated the proposed standards would require significant

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[23]See Item # II-E-08 in EPA Air Docket A-96-55 referencing a meeting between EPA and Honda.

research and development time as well as a large capital investment to change existing production capabilities. The proposed phase-in period plus the lead time anticipated after this rule is finalized will allow manufacturers at least 6 years to make the necessary changes to existing product lines in order to meet the proposed standards, which should accommodate the manufacturers' concerns regarding lead time.

The Agency has not proposed a handheld standard which would require catalyst or 4-stroke technology. The Agency's experience with on-highway technology indicates catalysts and engine technology evolved together to prevent significant in-use deterioration. As previously discussed in the section on the Class I engine standard, publicly available information on bench aged catalysts used on 4-stroke engines has become available in recent years. The Agency requests comment on the relationship between bench aged and typical in-use aged catalyst performance, and all available data on individual catalysts aged under typical in-use conditions experienced by handheld equipment. The Agency requests additional information on the new and in-use emission performance of catalyst-equipped handheld engines. Two engine manufacturers have introduced 4-stroke engines into string trimmer applications. There are likely some applications, such as high power chainsaws, where 4-stroke technology may not be feasible as a power unit because of weight concerns. As previously discussed, the Agency estimates that conversion to 4-stroke designs would cost the manufacturer between $7 and $10 per engine. PPEMA has reported that in 1993 and 1994 the average retail price of a 2-stroke gasoline powered string trimmer or leaf blower was approximately $100, and the average retail price of a chainsaw was approximately $200. PPEMA members, who do not currently manufacture 4-stroke handheld products, have expressed concern regarding what they perceive to be the potential negative impacts on sales which would result from a large increase in engine costs, such as the cost of conversion to 4-stroke technology for handheld engines. While EPA has no independent information on consumer price sensitivity, it is concerned that the higher cost of equipment which would likely result if catalyst or 4-stroke technology were necessitated by a more stringent standard could result in significant financial burden if the industry were to absorb the cost impact or adverse impact on sales if the increase in cost were passed along to the consumer. EPA is also concerned that mandating near term conversion to 4-stroke technology could significantly increase the lead time necessary before implementing the standards and delay the emission benefits of the standards. The Agency requests comment on the market concerns expressed by these engine manufacturers as well as the potential impact on lead time of a more stringent standard and information on the cost to the consumer and in-use emissions performance if 2-stroke engines were required to be equipped with a catalyst.

The Agency believes that during the next several years additional information regarding the in-use performance of new technologies, such as handheld 4-strokes, or traditional 2-strokes equipped with catalysts, may become available, perhaps in response to the CARB Tier 2 program. In addition, EPA recognizes that technological advances and/or cost reductions may occur after promulgation of the Phase 2 rule that could make greater, but still cost-effective reductions feasible in handheld emission levels. The Agency proposes to conduct a technology review to address this possibility. In this

review, EPA expects to examine issues including the potential for further reductions from existing 2-stroke engines, stratified charge 2-stroke technology, direct injection 2-stroke injection, the use of catalysts on handheld engines, and the conversion to 4-stroke technology. Following a technical review, the Agency intends to publish a Notice of Proposed Rulemaking in 2001 announcing any possible amendments to the standard levels or other program elements, or EPA's intention to maintain the existing handheld standards or program. The Agency expects that the final rulemaking would be completed by 2002 and, if adopted, Phase 3 standards would be phased in on a percentage basis and over of a period of time similar to Phase 2, beginning no earlier than model year 2007. This schedule is intended to provide a minimum five year period before the implementation of any Phase 3 standards in order to allow manufacturers to recoup their investments in Phase 2 technology and ensure the cost-effectiveness of the Phase 2 program.

The Agency is aware that CARB is considering a Tier 2 standard for all handheld engines of 72 g/kW-hr HC+NOx, which is more stringent than the levels being proposed for the Federal program. CARB has stated this level could be met by the complete conversion of existing 2-stroke technology to 4-stroke technology. The Agency believes the costs and lead time which would be necessary to achieve a 72 g/kW-hr level for a national program could be considerably higher than the program contained in today's proposal. However, as discussed under Section IV.A of this proposal, section 209 of the CAA allows California to set its own standards, considering criteria as they apply to the State of California. However, as discussed below, the Agency requests comment on whether 4-stroke technology for all handheld applications would be appropriate for a Federal program at this time. The Agency requests comment on all aspects of the proposed handheld standards, and on what adjustments to the proposed Federal program might be necessary to accommodate such standards.

d. Proposed California Standards

As mentioned previously, the State of California has proposed standards for both handheld and nonhandheld small SI engines which are considerably more stringent than the standards which the Agency is proposing today. In this proposal, the Agency has noted several reasons why the level of control being considered by California is not being proposed today, including uncertainties regarding cost, the possible impact of potential price increases on consumer sales, and the lead time necessary for the industry should they be required to adopt the required changes in technology nationwide. However, EPA requests comment on the feasibility in the Federal program of requiring such technology as anticipated by the standards being considered by California, the level of emission control which would result, the costs of such technology for a nationwide program, and any impact on lead time necessary to allow the adoption of such levels of control nationwide.

2. NMHC+NOx Emission Standards for Class I and II Natural Gas Fueled Nonhandheld Engines

EPA is proposing optional separate standards for Class I and Class II natural gas fueled engines only, due to the fact that for these engines methane has very low ozone forming potential, i.e., low reactivity. The total hydrocarbon (THC or HC) emissions from Phase 1 technology 4-stroke gasoline engines is between 5 and 10 percent methane by mass. For natural gas engines, methane is on the order of 70 percent of total HC mass emissions. For natural gas fueled nonhandheld engines, the Agency is proposing an optional NMHC+NOx standard, as presented in Table 12.

Table 12: NMHC + NOx Emission Standards for Natural Gas Fueled Nonhandheld Engines (g/kW-hr)

Engine Class	Model Year 2001	Model Year 2002	Model Year 2003	Model Year 2004	Model Year 2005
Class I	23.0	⇨	⇨	⇨	⇨
Class II	16.7	15.3	14.0	12.7	11.3

These proposed NMHC+NOx standards have been adjusted so that these standards are of equivalent stringency to the HC+NOx standards for gasoline fueled engines, i.e., 11.3 g/kW-hr NMHC+NOx is a deteriorated new engine NMHC+NOx level, assuming a new engine THC+NOx level of 9.3 g/kW-hr, a NMHC+NOx deterioration factor of 1.3, and a new engine split of 54 percent NMHC, 6 percent methane and 40 percent NOx.

The Agency is proposing that for natural gas fueled engines, the standard be based on the level of NMHC+NOx reduction which a Phase 2 technology gasoline fueled nonhandheld engine could be expected to meet, not on the performance of a Phase 2 technology natural gas fueled engine. Natural gas fueled engines represent less than 1 percent of annual small engine sales and EPA recognizes that this is a technology that as a matter of environmental policy it may be desirable to encourage. The Agency believes very little environmental benefit would occur from basing this optional NMHC+NOx standard on the performance of Phase 2 technology natural gas engines. In consideration of the energy and safety factors associated with using natural gas technology rather than gasoline technology, EPA is proposing the NMHC+NOx standard at a level that gives manufacturers a greater incentive, as a result of the ABT program, to use natural gas technology. The Agency requests comment on this approach, and on whether it poses a meaningful risk of allowing over generation of positive credits in the ABT program.

The NMHC+NOx standard would require an additional testing burden for natural gas engine manufacturers, because these manufacturers would need an additional emission analyzer to measure the methane content of the exhaust gas. However, because natural gas engine manufacturers have requested this optional NMHC standard, and the Agency does not see any adverse effects for the formation of ozone, the Agency believes it is appropriate for this proposal. EPA is not proposing NMHC + NOx standards for handheld engines. EPA is not aware of any natural gas fueled handheld applications. Therefore, no NMHC+NOx standard is needed.

The Agency is aware that CARB may use a NMHC+NOx standard for all handheld and nonhandheld engine manufacturers. At this time, EPA does not believe an emissions benefit would occur by replicating this action for the Federal program. The Agency would need to adjust all standards downward to maintain equivalent stringency and require all manufacturers to begin testing for methane. If manufacturers of small SI engines were able to selectively target reductions in NMHC as compared to THC, an NMHC standard may be of some value to manufacturers. However, the Agency is not aware of small engine technologies which have this potential, other than natural gas fueled engines, which represent less than 1 percent of annual sales. Therefore, because a national NMHC standard would result in increased testing cost for little or no benefit, the Agency is not proposing NMHC standards for all small engines at this time.

3. CO Emission Standards

In addition to HC and NOx standards, the Phase 1 final rulemaking (60 FR 34582) put in place a cap on the level of CO emissions from small SI engines. That cap was subsequently modified for Class I and II engines (61 FR 58296). In today's action EPA is proposing that the Phase 1 CO standards be adjusted to reflect in-use standards and to maintain the same level of stringency as afforded by the Phase 1 standards. Specifically, EPA proposes to take the Phase 1 standards and multiply them by the projected CO dfs over the useful lives of the engines to arrive at the Phase 2 in-use CO standards. For Class I and II engines, available data indicates that the df ranges considerably between less than 1.0 and something in excess of 2.0 depending on the engine. For Class III, IV and V engines, available data indicates that the df for CO ranges more narrowly and typically falls between 1.0 and 1.1. Consequently, EPA proposes that the following in-use CO standards in Table 13 apply for the Phase 2 program:

Table 13: In-Use CO Emission Standards for Small SI Engines (in g/kW-hr)

	Engine Class				
	I	II	III	IV	V
CO Standard (g/kW-hr)	610	610	805	805	603

These CO standards would not be subject to the averaging, banking, and trading provisions of the rule available for nonhandheld engines. Rather, these standards would serve as caps on the CO emissions allowed from all engine families.

EPA is proposing that for Class I and Class II engines, the proposed CO levels would be effective in the 2001 model year for a manufacturer's entire product line. For Class III, IV and V engines, those engine families complying with Phase 2 HC+NOx levels under the proposed phase-in for HC+NOx standards for handheld engines would be required to also comply with CO levels on the same phase-in schedule. This seemingly disparate treatment for handheld and nonhandheld is consistent with the other provisions

of the program (e.g., phase-in from Phase 1 to Phase 2 for handheld but not for nonhandheld engines) and protects manufacturers from having to have engine families comply with Phase 2 CO requirements prior to those same engine families being subject to the other Phase 2 requirements.

EPA believes it is appropriate not to go beyond the Phase 1 stringency for CO emissions for two main reasons. First, in most parts of the country CO is primarily a wintertime problem (November through February), while the vast majority of engines covered by this rulemaking are used almost exclusively during the summer months. As a result, most additional CO emission reductions resulting from any increase in the stringency of the standard would not occur at a time when they would provide nonattainment areas with measurable benefit toward meeting the National Ambient Air Quality Standard (NAAQS) for CO.

Second, CO is a diminishing ambient air quality problem.[24] There has been approximately an 80 percent reduction in the number of nationwide exceedances of the NAAQS for CO since the Clean Air Act Amendments of 1990, and this trend is expected to continue without further tightening of CO requirements for small SI engines. Many of the CO nonattainment areas in 1990 have already been redesignated as being in attainment, many more are in the process of requesting redesignation, and many of those not currently requesting redesignation are expected to before the time the Phase 2 standards would go into effect.

Taken together, these two reasons indicate that it does not make sense to pursue more stringent CO standards at the national level for small SI engines at this time. Should this situation change, EPA can take appropriate action at that time.

While EPA does not believe it is appropriate at this point in time to pursue more stringent CO standards for small engines, we nevertheless do believe it is important to maintain the current level of stringency for CO. As discussed in the Phase 1 rulemaking, uncontrolled small SI engines do contribute approximately 1 percent of the emissions toward the national winter CO inventory.[25] As a result, while emissions from small SI engines represent a small piece of the inventory, they are significant. Furthermore, many small SI engines are used outside in close proximity to the equipment users, raising possible concerns over user health effects. A recent National Institute of Occupational Safety and Health Alert[26] raised serious health concerns regarding the operation of gasoline powered engines inside buildings or other partially enclosed spaces due to potential CO poisoning. The NIOSH Alert contains a list of suggested practices for the

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[24]See "National Air Pollution Emission Trends, 1900-1995," EPA-454/R-96-007, October 1997.

[25]Nonroad Engine and Vehicle Emission Study - Report, U.S. EPA, November 1991, EPA Air Docket A-91-24, Item #II-A-10.

[26]"Preventing Carbon Monoxide Poisoning from Small Gasoline-Powered Engines and Tools," Department of Health and Human Services Publication #96-118. Information on how to obtain this publication is contained in EPA Air Docket A-96-55, Item #II-B-1.

proper use of equipment powered by small gasoline engines which should be followed. The NIOSH alert does not recommend a more stringent CO standard for gasoline powered small SI engines.

Even without a more stringent CO standard for Phase 2, CO emissions from small engines will likely continue to decrease as manufacturers improve production quality (reduce tolerances and variability) and improve durability to meet the more stringent HC+NOx standards proposed for Phase 2. To the extent that this does occur, and Phase 2 engines are shown to clearly achieve the Phase 2 CO emission standards, the proposal would allow EPA the flexibility to waive the reporting of CO emissions in the future, thereby decreasing the compliance costs associated with the program as it transitions to one more focussed on HC+NOx emissions. EPA requests comment on this aspect of the proposed rule. To the extent that engines do exceed the Phase 2 CO emission standard, EPA could also consider in the future setting a more stringent CO standard, taking into account cost, lead time, energy and safety factors as required by the Clean Air Act.

4. Useful Life Categories

Section 213(a)(3) of the Clean Air Act provides that regulations promulgated for nonroad engines shall apply to the useful lives of the engines. EPA is proposing that engine families meet the proposed Phase 2 emission standards throughout their useful lives, a requirement new to this Phase 2 program for small SI engines. Small SI engines can experience a wide range of useful lives, depending upon the applications and usage patterns, even within a single engine class. EPA believes that the three useful life categories each for Class I and Class II engines, and the two useful life categories each for Class III, IV and V engines proposed today would provide a means of sorting engines for regulatory purposes to reflect expected usage, without establishing an overly complex system of useful life categories. So that consumers have the best information available as to the emission durability of the engine being purchased, EPA is proposing that an indication of the useful life hours be included on the engine's certification label. Finally, in order to ensure that the air quality benefits anticipated by the proposed rule will in fact accrue, EPA is proposing that manufacturers select the useful life category most appropriate for the engine family. This section discusses the useful life categories proposed today for nonhandheld and handheld engines, proposed provisions for inclusion of the useful life hours on the engines' label, and proposed provisions relating to manufacturer selection of the appropriate useful life category.

a. Useful Life Hours

EPA is proposing three useful life categories each for Class I and Class II nonhandheld engines, and two useful life categories each for Class III, IV and V handheld engines, as shown in Tables 14 and 15. These categories are based on information of the ranges of useful lives experienced by the engines in these Classes.

Table 14: Nonhandheld Engine Useful Life Categories (hours)			
	Category C	Category B	Category A
Class I	66	250	500
Class II	250	500	1000

Table 15: Handheld Engine Useful Life Categories (hours)		
	"Residential"	"Commercial"
Class III	50	300
Class IV	50	300
Class V	50	300

EPA is aware that the small SI engine and equipment industry is comprised of a wide variety of equipment with a wide range of usage patterns. Handheld and nonhandheld engines are designed for many different types of applications, with each application having specific design criteria, resulting in different expected lifetimes. The most obvious example of these differences is the distinction between commercial (or professional) operators and residential (or home) operators. In general, commercial operators, such as commercial lawn-care companies or rental companies, expect to accumulate high numbers of hours on equipment on an annual basis, while a residential operator, such as a residential chain saw owner, expects to accumulate a relatively low number of hours on an annual basis. Several organizations have investigated the issues related to average life and annual use of equipment powered by small SI engines, including industry organizations, the California Air Resources Board, and EPA (see Chapter 3 of the Draft RSD for a summary of several of these reports).

On the nonhandheld engine side, a 1992 phone survey of over 6,000 households collected information on usage rates for consumer-owned walk-behind and ride-on mowers, showing that on average consumers accumulated 100 hours of use on walk-behind mowers (typical of Class I "residential" engines) over a five year period of time, and 207 hours of use on ride-on mowers over a six year (five and six years being the estimates of when one-half of the mowers are no longer in service, or "B-50" life,[27] for

[27]The "B-50" is the point at which one-half of the equipment are no longer in service. For regulatory purposes, EPA anticipates that engines would be certified to a "useful life" which most accurately reflects this "B-50" value. Thus, for a Class II engine family certified to the 250 hour useful life category, half of those engines would be expected to no longer be in service after 250 hours.

walk-behind and ride-on mowers, respectively).[28] On the handheld side, a 1990 study demonstrated the large disparity between consumer and professional use, with consumer equipment expected life time estimates ranging from 53 to 80 hours, and professional equipment expected life time estimates ranging from 225 to 536 hours.[29] A 1990 study of both nonhandheld and handheld equipment in residential and commercial applications showed a large disparity in average lifespan between equipment used by residential and commercial applications, with residential equipment implied average lifespan estimates ranging from 35 to 394 hours, and commercial equipment implied average lifespan estimates ranging from 274 to 3024 hours.[30]

Based on these sources of information, EPA is proposing for regulatory purposes three useful life categories for nonhandheld engines, and two useful life categories for handheld engines. The determination of which useful life category is appropriate for a specific engine is largely dependent on its intended application. For example, Class II engines going into a consumer ride-on mower application may most appropriately have a regulatory useful life of "250 hours." The longer useful life categories would be appropriate for engines placed into "commercial" types of usage. For example, a Class II engine going into a "commercial" generator set application, may most appropriately have a regulatory useful life of 1000 hours. EPA believes that a number of features of engine and/or equipment design are reflective of the intended or expected usage of the engines. As discussed below, manufacturers would be expected to have information on the intended application of their engines which support their useful life category selections.

EPA received comments on the ANPRM arguing that the Class I shortest useful life (66 hours) is too short, and that the minimum lifetime compliance period for Class I engines should be set at 120 or 125 hours to reflect an average six year life with an average use of 20 hours a year for mower engines. While the Agency agrees that 120 or 125 hours may be more representative of the "B-50" life of residential Class I engines, EPA selected 66 hours as sufficient to determine the emission durability performance characteristic of engines in this Class I design category. EPA did so under the assumptions that certifying Class I engines to 66 hours rather than 120 or 125 hours would still provide adequate assurance of in-use emission performance over the life of the

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[28]"Useful Life, Annual Usage, and In-Use Emissions of Consumer Utility Engines," memo from the OPEI CAAC In-Use Working Group to Ms. Gay MacGregor, U.S. EPA, EPA Air Docket A-96-55, Item # II-D-13.

[29]"A 1989 California Baseline Emissions Inventory for Total Hydrocarbon and Carbon Monoxide Emissions from Portable Two-Stroke Power Equipment," prepared by Heiden Associates, Inc., for the Portable Power Equipment Manufacturers Association, July 24, 1990, available in EPA Air Docket A-96-55, Item #II-D-14.

[30]"Utility Engine Emission report," prepared by Booz, Allen and Hamilton Inc., for the California Air Resources Board, November 20, 1990, available in EPA Air Docket A-93-25, Item #II-I-02. These implied average lifespan estimates were calculated from average annual use and estimated "B-50" values.

engines without the added burden which would be incurred with testing to the higher hours. If this proves not to be the case, EPA would likely have to adjust the useful life, deterioration factors and standards accordingly to provide such assurance. EPA requests comment on the tradeoff between compliance demonstration and in-use compliance assurance associated with the 66 hour useful life proposal.

For handheld engines, the 50 hours category reflects "residential" usage, and the 300 hour category reflects "commercial" usage. For example, a trimmer in residential use may most appropriately be certified to a regulatory useful life of 50 hours, while a chainsaw in commercial use may more appropriately be certified to a useful life of 300 hours. Again, EPA believes that a number of features of engine and/or equipment design are reflective of the intended or expected usage of the engines. As discussed below, manufacturers would be expected to have information in support of their useful life category selections for handheld engines.

EPA received comments on the ANPRM arguing that an intermediate useful life category for some handheld products might be appropriate, for example, in the case of products with intended useful lives of 150 hours. EPA believes that the 50 and 300 hour useful life hour categories are sufficient to distinguish residential and commercial usage, respectively. EPA has not received additional data in support of an intermediate useful life, and believes that it is desirable to avoid a proliferation of useful life categories. Thus, EPA is not proposing an intermediate useful life category for handheld engines. However, EPA requests comment and data on the issue of whether an intermediate category is appropriate, what would be the appropriate hours for an intermediate category, and what features of an engine with an intermediate useful life might distinguish it from engines more appropriately certified to a 50 or a 300 hour useful life.

EPA also received comments on the ANPRM regarding the use of "residential" and "commercial" to indicate the useful life for handheld engines. Several commenters suggested that the terms "residential" and "commercial" are potentially misleading to consumers of handheld engines. One commenter was concerned that dealers would have the responsibility to "qualify" a buyer of equipment, and in the event of injury, the dealer would be at risk for having sold the wrong buyer the wrong equipment. This commenter suggested instead that EPA categorize engines in terms of power, size, weight, or other factors that clearly would not risk making dealers think they have a responsibility to classify the expertise of the buyer. A second commenter suggested EPA could base the useful life on technical properties of engines such as "half crank" and "full crank" rather than "commercial" and "residential." A third industry commenter suggested that it is unnecessary and unwise for manufacturers to differentiate handheld engine families by the terms "residential" and "commercial," since these terms are not airtight, and in fact have substantial overlap for some models. This commenter suggested using useful life categories "A" and "B" instead, where a Category A engine (or engine family) would be "a handheld engine model or family designated by the manufacturer, at the time of certification, as an engine intended primarily for commercial use. Such an engine or family would be subject to testing requirements and warranty obligations for its regulatory useful life. The regulatory useful life of a Category A engine shall be 300 hours." A

Category B engine (or engine family) would be "an engine model or family designated by the manufacturer, at the time of certification, as an engine intended primarily for residential use. Such an engine or engine family would be subject to testing requirements and warranty obligations for its regulatory useful life. The regulatory useful life of a Category B engine shall be 50 hours."

EPA agrees that commercial and residential are not airtight terms. However, EPA is proposing the following definitions for these terms and requests comments on these definitions. A "residential engine" would mean a handheld engine for which the engine manufacturer makes the statement to EPA that such engine and the equipment it is installed in by the engine manufacturer, where applicable, is not produced, advertised, marketed or intended for commercial or professional usage. A "commercial engine" would mean a handheld engine that is not a residential engine.

In response to the commenter's concerns about dealer responsibilities, EPA believes that inclusion of the terms "residential" and "commercial" should not pose a risk to dealers, and that the proposed duty of engine manufacturers to certify and label their engines for purposes of emissions durability would not transfer into a duty on the dealer's part to restrict sale of "commercial" products to "residential" purchasers. EPA requests comment on all aspects of the proposal for handheld useful life categories and the proposed definitions of "commercial" and "residential", or other alternative designations for the 50 and 300 hour useful life categories. In particular, EPA requests comment on eliminating the use of residential and commercial as regulatory terms, and simply retaining the "50" and "300" hour useful life categories.

In summary, the Agency's analysis indicates there is a large disparity in the useful life of engines within all five engine classes. The Agency is interested in striking a compromise between the need for representative useful lives, and the reality that different engines within a single class are designed for vastly different usage patterns. For this reason the Agency believes it is appropriate to have multiple useful life categories, but the Agency believes there should be a limit on the number of categories, to prevent an overly complex categorization system. Based on the information presented in this section, the Agency believes the proposed useful life categories presented in Tables 14 and 15 are appropriate. The Agency requests comment on these proposed useful life categories.

b. Useful Life on the Engine's Label

EPA is proposing that manufacturers would indicate their selection of useful life category by adding information concerning the engine's "emissions compliance period" to the engine's label. This information would be an important tool for consumers and purchasers of engines. EPA anticipates that manufacturers will use the useful life hours of the engine as a marketing tool. For example, a manufacturer might advertise that an engine family is emissions durable to 1000 hours, or is certified by EPA as a "commercial" engine. Thus, the requirement that manufacturers indicate the emissions compliance period on the engine's label would also have potential as a marketplace mechanism to help encourage manufacturers to select longer useful life categories.

For nonhandheld engines, EPA is proposing that the manufacturer would add to the compliance statement on the engine's label, "EMISSIONS COMPLIANCE PERIOD: [useful life] HOURS." In addition, consistent with the ANPRM, EPA is proposing as an option for nonhandheld manufacturers, rather than indicating the useful life in hours, the manufacturer may add to the compliance statement on the engine's label "EMISSIONS COMPLIANCE PERIOD: CATEGORY [A, B, OR C]. REFER TO OWNER'S MANUAL FOR FURTHER INFORMATION." In this case, the owner's manual would be required to contain the statement: "This engine has been shown to meet emission standards for a period of [useful life] hours." EPA is proposing this option in light of concerns voiced by manufacturers that putting the useful life of the engine, in hours, on the engines' label, could be misleading to consumers in that the emissions compliance period may or may not represent the expected lifetime of the engine. Nevertheless, EPA believes that putting the engine's useful life in hours on the engine's label could serve as an important mechanism to educate and inform consumers as to the emissions durability of the product they are considering. EPA requests comment on whether the option to allow a manufacturer to instead designate the useful life by using Category [A, B or C] on the engine's label, with information on the emissions compliance period in hours in the owners manual, is an effective substitute to achieve this goal of educating consumers.

In the case of handheld engines, the manufacturer would add to the compliance statement on the engine's label, for residential engines, "EMISSIONS COMPLIANCE PERIOD: 50 HOURS," and for commercial engines, "EMISSIONS COMPLIANCE PERIOD: 300 HOURS." Again, EPA believes that including the useful life, in hours, on the engine's label, is an important mechanism for educating consumers as to the emissions durability of the engine. EPA requests comment on whether requiring the designation "EMISSIONS COMPLIANCE PERIOD: 50 RESIDENTIAL HOURS," or "EMISSIONS COMPLIANCE PERIOD: 300 COMMERCIAL HOURS" would be more effective as the proposed requirement to only include the emissions compliance period, by hours, on the label. Similar to the option for nonhandheld engines, EPA is requesting comment on an option which would allow handheld engine manufacturers to use label statements which include a useful life category code (such as A, B, or C) and referencing the owner's manual to determine what the code means.

c. Manufacturer selection of useful life category.

One of EPA's goals in the proposed Phase 2 program is to assure that engines are emissions durable for their useful lives, so that the air quality benefits anticipated for the rule are in fact achieved. EPA believes that the selection of the appropriate useful life category for an engine family is essential to achieving this goal. An appropriate useful life selection is important from an emissions compliance durability perspective, in terms of assuring that engines meet the appropriate emissions standards for the period of time that they are expected to be in service. However, EPA is concerned that since the useful life of engines, in hours, would be included in certification credit calculations for nonhandheld engines, and in-use credit calculations for handheld engines, and since these credits have real value, a manufacturer may have an important incentive to choose a

useful life category for a particular family to maximize the manufacturer's credit balance, rather than to reflect the most accurate useful life selection for that family.

For example, in the case of a nonhandheld engine family whose FEL is significantly below the standard and is therefore generating substantial credits, a manufacturer could generate four times as many certification credits if that family were certified to 1000 hours rather than 250 hours. Similarly, for a handheld engine family whose in-use test results are well below the standard, that family could generate six times as many in-use credits if certified to 300 hours rather than 50 hours. However, in cases where the credit generating engine is not expected to be used for 1000 hours (or 300 hours, in the handheld example), those clean air benefits may never be realized if the typical engine for that family is scrapped substantially before reaching 1000 hours of use. The "surplus" credits might be used to make up for higher emissions of other engine families even though the credits were generated based on an overestimation of the useful life. On the other hand, for engines which are emitting above the standard, the manufacturer might have an incentive to certify to the shortest useful life period, to minimize the credits needed to offset that engine's higher emissions. This could become an even greater concern if that engine is in fact expected to be placed into an application which experiences longer hours of use than indicated by the selected useful life category.

From an air quality perspective, a consumer education perspective, as well as from a marketing or competitive perspective, EPA believes that selection of an appropriate useful life is important, and certifying an engine to an inappropriate or inaccurate useful life presents serious problems. However, no one technical feature of an engine model would necessarily dictate that it be placed in one or another useful life category, and the distinctions between the useful life categories proposed today are not based on objective technical differences between engines (e.g., half crank, full crank).

EPA also recognizes that historically engine manufacturers have not always tracked the sale of engines, and may not have been able to ascertain the type of application in which an engine is used. On the other hand, EPA is also aware that in many cases manufacturers are able to determine the end application for a particular engine, and that in many cases an engine is designed for a specific end use.

Manufacturers, stressing that the nonhandheld SOP, as reflected in the March 1997 ANPRM, discussed useful life selection as being solely at the manufacturer's discretion, have maintained that marketing and competitive concerns would ensure that manufacturers select the most accurate and appropriate useful life category, and that additional requirements that manufacturers support their useful life selections are not needed. EPA understands that manufacturers have strong views regarding the nonhandheld SOP's discussion of useful life selection. However, the SOP indicates that it would be appropriate to certify engines to longer useful life categories when they are intended for longer hours of operations in-use. The signatories of the SOP further recognized that the greater use of an engine during the ozone season directly relates to its impact on air quality. In addition, since the signing of the SOP, EPA has become concerned that a number of various incentives are at play for the manufacturer when it comes to selection of a useful life category for an engine, including the requirement to

demonstrate the engines' emissions durability, testing requirements and warranty obligations, generation or use of emissions credits, consumer education, and marketing and competitive issues. EPA is concerned that a manufacturer might inappropriately select useful life categories for certification so as to put itself in a position of competitive advantage compared to other manufacturers that fairly and accurately select useful life categories, and that the risk of this could cause other manufacturers to follow suit in order to remain competitive.

Therefore, to assure that no individual manufacturer is unfairly biasing its useful life selections in order to take advantage of the credits programs, EPA is proposing that all manufacturers would declare the applicable useful life category for each engine family at the time of certification, and would be required to retain at their facilities data appropriate to support their selections of useful life categories, to be furnished to the Administrator upon request. The manufacturer would be required to select the category which most closely approximates the actual useful lives of the equipment into which the engines are expected to be installed. The rule would also require manufacturers to have data supporting their selections sufficient to show that the majority of engines or a sales weighted average of engines of that family are used in applications having a useful life best represented by the chosen category. EPA would not expect to request such data unless there is evidence of problems with a manufacturer's useful life selections. Such problems might be indicated, for example, if all or the major portion of a manufacturer's credit-generating engine families were certified to the longest useful life categories, or if all or the major portion of a manufacturer's credit-using engine families were certified to the shortest useful life categories.

EPA is proposing that data in support of a useful life category selection could include: surveys of the life spans of the equipment in which the engines are installed; engineering evaluations of field aged engines to ascertain when engine performance deteriorates to the point where usefulness and/or reliability is impacted to a degree sufficient to necessitate overhaul or replacement; warranty statements and warranty periods; marketing materials regarding engine life; failure reports from engine customers; and engineering evaluations of the durability, in hours, of specific engine technologies, engine materials, or engine designs. EPA expects that retaining these types of data at their facilities would not be unduly burdensome to manufacturers, and that in most cases these types of data would be information that the manufacturer already has on hand. EPA requests comment on these types of data and their usefulness in helping to distinguish the most accurate and appropriate useful life category for a particular engine family.

Finally, EPA proposes that in the event that EPA reviewed data provided by the manufacturer in support of the useful life selection, and upon review of that and such other information available and discussion with the manufacturer EPA believed that a different useful life category would be more appropriate, the Agency would work with that manufacturer to determine a more appropriate selection of useful life categories. EPA requests comment on all aspects of this proposal.

5. Certification Averaging, Banking and Trading Program

With today's notice, EPA is proposing a certification averaging, banking and trading (ABT) program for nonhandheld small SI engines. The proposed program would be the first ABT program for nonhandheld small SI engines. The Phase 1 rule did not include an ABT program due to uncertainties regarding the in-use emission levels of engines certified to the Phase 1 standards. (The Phase 1 standards apply to "new" engines and do not require any determination of in-use deterioration as the proposed Phase 2 standards do.)

The Agency is not proposing a certification ABT program for handheld engines at this time. Based on the levels of the proposed standards and discussion with engine manufacturers, EPA does not believe a certification ABT program is warranted or desired for handheld engines. The Agency specifically requests comment on this issue. As discussed later, EPA is proposing an in-use credit program for handheld small SI engines that would be used to address potential in-use emission exceedances. The reader is directed to Section IV.D.3 of today's notice for further details of the proposed in-use credit program for handheld engines.

The nonhandheld small SI engine ABT program proposed today is a market-based incentive program designed to provide an incentive for early introduction of clean technologies, and provides engine manufacturers with additional flexibility for meeting the proposed HC+NOx standards, while protecting the environmental benefits of the program. Implementation of the program should also reduce the cost of controlling HC+NOx emissions from nonhandheld engines.

EPA believes that the proposed ABT program is consistent with the statutory requirements of section 213 of the Clean Air Act. Although the language of section 213 is silent on the issue of averaging, it allows EPA considerable discretion in determining what regulations are most appropriate for implementing section 213. The statute does not specify that a specific standard or technology must be implemented, and it requires EPA to consider costs, lead time, and other factors in making its determination of "the greatest degree of emissions reduction achievable through the application of technology which the Administrator determines will be available." As noted in the proposal for Tier I nonroad compression-ignition engine standards, which also contained a certification ABT program, section 213(a)(3) also indicates that EPA's regulations may apply to nonroad engine classes in the aggregate, and need not apply to each nonroad engine individually (see 58 FR 28809, May 17, 1993).

At the same time, EPA believes that any ABT program must be consistent with the statutory requirement that standards reflect the greatest degree of emission reduction achievable through the application of available technology. EPA believes the proposed ABT program is fully consistent with such a requirement. The proposed HC+NOx emission standard of 25.0 g/kW-hr for Class I engines and the series of declining HC+NOx standards for Class II engines were developed under the assumption that an ABT program would take effect at the same time as proposed standards, once adopted. In fact, as discussed earlier in Section IV.A.1, the conclusion that the proposed standards for Class I and Class II engines are feasible for all affected nonhandheld engines within the time available to manufacturers, is based in part on the availability of the proposed ABT program. In addition, the flexibilities provided to engine manufacturers via an ABT

program should allow compliance with the proposed standard at a lower cost than may otherwise be the case. It is also possible that ABT allows the standard to be implemented sooner since, for example, not every family may need to be redesigned to meet the lower standard. If each engine family had to comply with the standards, the standards might be higher and/or the standards might need to be implemented later.

As noted above, the three aspects of the proposed ABT program are averaging, banking, and trading. Averaging means the exchange of emission credits among engine families within a given engine manufacturer's product line. Averaging allows a manufacturer to certify one or more engine families at levels above the applicable emission standard. However, the increased emissions would have to be offset by one or more engine families within that manufacturer's product line certified below the same emission standard, such that the average emissions in a given model year from all the manufacturer's families (weighted for engine power, useful life, load factor, and sales) are at or below the level of the emission standard. Averaging results would be calculated for each specific model year and, as proposed today, would be calculated for each engine class. The mechanism by which this is accomplished would be certification of the engine family to a "family emission limit" (FEL) set by the manufacturer, which may be above or below the standard. An FEL that is established above the standard could not exceed an upper limit specified in the ABT regulations. Once an engine family is certified to an FEL, that FEL would become the enforceable emissions limit used for compliance purposes and each engine in the engine family would be subject to compliance with the FEL.

Banking means the retention of emission credits by the engine manufacturer generating the credits for use in future model year averaging or trading. EPA believes that banking, including today's proposed provision which would allow early banking under certain conditions during the two years prior to implementation of the standards, would improve the feasibility of meeting standards by encouraging the development and early introduction of advanced emission control technology, allowing certain engine families to act as trailblazers for new technology. This can help provide valuable information to manufacturers on the technology prior to manufacturers needing to apply the technology throughout their product lines. An incentive for early introduction arises because the banked credits could subsequently be used by the manufacturer to ease the compliance burden of new, more stringent standards.

Trading means the exchange of emission credits between engine manufacturers which then can be used for averaging purposes, banked for future use, or traded to another engine manufacturer. Trading can be advantageous to smaller manufacturers who might have limited opportunity to optimize their costs through the use of averaging. Trading can also be advantageous to larger manufacturers because extending the effective averaging set through trading can allow for overall optimization of costs across manufacturers.

EPA is proposing that participation in the proposed ABT program for Phase 2 nonhandheld small SI engines would be voluntary. For those manufacturers who choose to utilize the program, compliance of individual engine families with their FELs would be determined and enforced in the same manner as compliance with the emission standards

in the absence of an ABT program. In addition, except where specifically permitted in the case of production line testing failure (see section IV.D.2. of today's notice), the final number of credits available to the manufacturer in each engine class at the end of a model year after considering the manufacturer's use of credits from ABT would have to be greater than or equal to zero. Specific elements of the proposed ABT program for nonhandheld small SI engines are discussed below.

a. Calculation of Credits

Credits would be calculated as a function of the difference between the applicable Phase 2 emission standard and the FEL, the power, the useful life, the load factor, and the number of eligible engines sold of the engine family participating in the program. (Since the standards are expressed in terms of grams/kW-hour, the "power" and "load factor" variables are included to allow averaging across engines designed to different power.) EPA would expect manufacturers to follow the regulations for establishing its engine families and not disaggregate their families into multiple families or combine their existing families into fewer families to maximize credit generation or minimize credit usage. EPA is proposing the following equation for calculating the emission credits from a given engine family, whether generating positive or negative credits.

Credits = (Standard - FEL) x (Power) x (Useful Life) x (Load Factor) x (Sales)

"Standard" represents the applicable Phase 2 emission standard as proposed by EPA. "FEL" is the family emission limit for the engine family as established by the manufacturer. "Power" represents the engine's maximum modal power produced during the certification test cycle. For those engine families that contain more than one configuration with different power ratings, EPA is proposing that the "Power" term be the sales-weighted maximum modal power determined across all configurations within the engine family. EPA assumes manufacturers know the general power characteristics of each of their engine configurations they are producing, and therefore, determining the power information necessary for the ABT calculations will not place any additional testing burden on manufacturers. EPA requests comment on this assumption.

"Useful Life" is the useful life category to which the engine family is certified, and represents the period of time for which the manufacturer is responsible for compliance with the emissions standards. "Load Factor" refers to the fraction of rated power at which the engine operates in use, on average. For the two main certification test cycles, referred to as cycle "A" and cycle "B", which EPA believes represent typical in-use operation, a load factor of 0.47 is proposed. For alternative test cycles, as approved by EPA, the load factor would need to be calculated based on the characteristics of the test procedure as described in the proposed regulations.

"Sales" represents the eligible number of Phase 2 engines sold in the United States in the applicable model year, excluding those engines subject to California regulations. Manufacturers would be allowed to use sales projections for initial certification. However, actual sales based on the location of the point of first retail sale (for example,

retail customer or dealer) would have to be submitted at the end of the model year to verify end-of-year compliance. The Agency is proposing that manufacturers exclude engines subject to California's emission standards from the estimates of eligible engine sales because California will likely require all engines sold in California to meet its own tighter HC+NOx standards. If California engines were included, then the credits generated by California sales would allow more engines with higher emission rates to be sold in states outside of California. This would detract from the goals of the Phase 2 program, and possibly undermine the emissions reductions expected to be achieved by the program throughout the country. Engines sold outside of the United States, including Canada and Mexico, would also be excluded from the manufacturer's estimates of sales unless those engines are subsequently imported back into the United States in a new piece of nonhandheld equipment.

Because only those engines sold in the United States, excluding engines subject to California's standards, would be included in the ABT program, manufacturers would need to determine the number of such engines sold each year to yield accurate estimates of credit generation and usage. Due to the difficulty in tracking point of first retail sales in the nonhandheld market compared to other markets (e.g., the on-highway segment where a more direct engine and vehicle distribution system exists), EPA is requesting comments on alternative methods manufacturers could use to determine their eligible sales for credit calculations. One possible option would be to allow engine manufacturers to query their customers, on an annual basis, to ascertain the percentage of Phase 2 engines of each family that constitute eligible sales. Based on the results of the query, the Agency could allow manufacturers to extrapolate those results, assuming they received responses sufficient to cover some high percentage of their sales, say 90 percent or more, to its total sales of engines in the United States. The Agency is open to considering other alternative methods for tracking engines for credit calculation purposes that provide high levels of confidence that eligible sales are accurately counted. EPA specifically requests comments on such alternatives and other information that would further address the Agency's concerns that eligible sales estimates be as accurate as possible. In addition, the Agency requests comments on appropriate methods for estimating the export of engines and the sales of engines subject to California's standards, since one method for estimating eligible sales for ABT purposes could be to deduct these two groups from total sales.

As discussed in Section IV.E of today's notice, EPA is proposing several compliance flexibility provisions for engine manufacturers and equipment manufacturers that would allow the limited use of Phase 1 engines in the Phase 2 time frame. To avoid penalizing manufacturers that produce engines to be used under the proposed flexibility provisions, EPA is proposing that manufacturers exclude such engines from the ABT program calculations. In other words, engine manufacturers would not be required to use credits to certify these Phase 1 engines used for the proposed flexibility provisions even though they would likely exceed the proposed Phase 2 standards.

Another proposed flexibility provision described in Section IV.E of today's notice would allow engine manufacturers to certify beyond the 2005 model year Class II side-valve engine families with annual sales of less than 1,000 units to an HC+NOx cap of

24.0 g/kW-hr. For such engine families, EPA is proposing that manufacturers do not need to include such families in the ABT program calculations for 2005 and later model years. For the interim years, 2001 through 2004, a manufacturer could also exclude Class II side-valve engine families with annual sales of less than 1,000 units from the ABT program calculations as long as the deteriorated HC+NOx emission level of the engine is less than 24.0 g/kW-hr. Class II side-valve engine families with annual sales of less than 1,000 units that are certified above the 24.0 g/kW-hr HC+NOx level must be included in the manufacturers' ABT calculations during the interim years.

EPA is proposing an upper limit on the level of emissions allowed from those engine families a manufacturer wishes to include in the ABT program. Under the proposal, manufacturers would not be allowed to certify engines that have FELs above the upper limits described below. Typically, when EPA adopts an ABT program, the upper limit is set at the level of the previous standard. However, because the Phase 1 standards did not require manufacturers to take into account deterioration over the useful life of the engine as the proposed Phase 2 standards do, EPA believes it is appropriate to use the Phase 1 standards as the basis for calculating the upper limits and apply a deterioration factor to determine the equivalent deteriorated level of the Phase 1 emission standards. Based on the predominant side-valve engine technology certified under the Phase 1 program, EPA estimates that a typical Phase 1 engine would have emissions at the end of the useful life period about twice its new engine emission level.[31] Therefore a deterioration factor of 2.0 is appropriate for estimating the equivalent useful life level of engines designed to meet the Phase 1 standards. Based on the Phase 1 HC+NOx standards and a deterioration factor of 2.0, EPA is proposing HC+NOx upper limits of 32.2 g/kW-hr for Class I engines and 26.8 g/kW-hr for Class II engines. Therefore, a manufacturer would be allowed to certify an engine family only if the HC+NOx FEL were at or below these proposed levels (and only if they had the appropriate number of credits to offset the family's credit needs). For families not participating in the ABT program, each family must comply with the standard which in effect is an analogous upper limit. EPA requests comment on the appropriateness of the proposed upper limits for engine families included in the ABT program.

Due to concerns over the amount of credits manufacturers could accumulate, as described below, EPA is proposing a declining set of caps on how high the sales-weighted average level of HC+NOx FELs could be for Class II engine families beginning in 2005. Based on the certification information of Phase 1 nonhandheld engines submitted by manufacturers to EPA and assumptions about typical deterioration factors and compliance margins, it appears that some engine manufacturers have the potential to earn significant credits from their Class II engines prior to the 2005 model year. (Because the proposed emission standard for Class I engines assumes side-valve technology and because most Class I engines are expected to remain side-valve technology, it does not

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[31]See "Summary of EPA Analysis Regarding Upper Limits for Phase 2 Averaging, Banking & Trading Program for Nonhandheld Engines", Item #II-B-05 in EPA Air Docket A-96-55.

appear that there would be the same potential for significant credit generation by Class I engine manufacturers.) Manufacturers who adopt OHV technology earlier than anticipated by the proposed Class II phase-in standards appear best positioned to accumulate significant credits. The ability to generate credits during the transition years would occur primarily because the typically lower-emitting OHV engines could earn credits up to the proposed applicable model year standards (which, as noted earlier, would decline for each model year between 2001 and 2005 and assume an industry changeover to the cleaner OHV engines from the higher-emitting side-valve engines).

The environment benefits when a manufacturer produces engines which, on average, are cleaner than required during the transition years. However, EPA is concerned that some manufacturers, because their current product line is predominantly made up of OHV technology, would be able to accumulate significant credits during the phase-in years without any additional effort to improve emission performance. These credits could be, in turn, used by such manufacturers beginning in 2005 to, in effect, delay the need for that manufacturer to produce engines meeting the proposed 2005 model year standard. This action could put such manufacturers in a competitively advantageous position compared to manufacturers who did not have substantial credits and therefore needed to produce a product line which, on average, met the 2005 model year standard. Such action could similarly undermine the goal of this rule (and the SOP) to have 100 percent OHV technology (or similar technology meeting the 2005 model year standards) in place across the industry for Class II by 2005.

In order to ensure that this transition to cleaner technology occurs by the 2005 model year and to minimize the risk of credit "build-up" resulting in a delay of conversion to OHV or OHV-comparable technology, EPA is proposing that a manufacturer's sales-weighted average of Class II HC+NOx FELs may not exceed 13.6 g/kW-hr in 2005, 13.1 g/kW-hr in 2006, and 12.6 g/kW-hr in 2007 or later. EPA believes this approach would ensure that Class II engines are converted to OHV or OHV-comparable technology by roughly 2005 while still encouraging the early introduction of cleaner, more durable technology and ensuring that manufacturers have the flexibility they need to comply with the proposed standards. EPA requests comment on the proposed caps and alternative approaches that would ensure the introduction of OHV or OHV-comparable technology by approximately 2005 while maintaining the flexibility offered to manufacturers by ABT and the encouragement to pull ahead cleaner, more durable technology.

As described earlier, EPA is proposing separate NMHC+NOx standards for natural gas-fueled engines which are intended to be as stringent as the proposed HC+NOx standards for the remaining nonhandheld small SI engines. All credit calculations for natural gas-fueled engines would be calculated against those standards. In addition, because the proposed standards are equivalent in stringency, and the market for nonhandheld natural gas-fueled small SI engines is extremely small (i.e., less than 0.1 percent of current nonhandheld sales), EPA is proposing to allow manufacturers to freely exchange NMHC+NOx credits from nonhandheld engines fueled by natural gas with HC+NOx credits from nonhandheld engines fueled by fuels other than natural gas in the ABT program.

b. Life of Credits

For all credits generated by Class I and Class II engines under the certification ABT program, EPA is proposing an unlimited credit life. EPA believes that unlimited life for these credits will promote the feasibility of the proposed Phase 2 Class I and Class II standards because it increases the value of these credits to the manufacturer by providing greater flexibility for the use of the credits. It is consistent with the general emission reduction goal of ABT programs, not only because of the increased manufacturer incentive but also because it reduces the incentive for manufacturers to use their credits as quickly as possible. As a result, unused credits, which are extra emission reductions beyond what the EPA regulations require, may remain off the market longer. It should be noted that EPA would expect to reconsider the appropriate life of Phase 2 emission credits in connection with any post-Phase 2 rulemaking for nonhandheld engines.

c. Early Use of the ABT Program

EPA is proposing that manufacturers be allowed to use the ABT program prior to implementation of the Phase 2 standards to provide an incentive to accelerate introduction of cleaner technologies into the market. The Agency believes that making bankable credits available prior to 2001 would reward those manufacturers who take on the responsibility of complying with the proposed standards sooner than required and would result in early environmental benefits. Under the proposed provisions, manufacturers would be allowed to begin using portions of the ABT program starting two model years before the proposed standards take effect provided the manufacturer certifies and complies with the proposed 2001 model year standards of 25.0 g/kW-hr for Class I engines and 18.0 g/kW-hr for Class II engines for their entire product line in a given nonhandheld engine class. The manufacturer could show it is in compliance with the proposed standards for each individual engine family or on average using the averaging provisions of the proposed ABT program. If a manufacturer meets this condition, the manufacturer could generate early credits to be banked for use in the 2001 or later model years from only those engines certified below 16.0 g/kW-hr HC+NOx for Class I engines and below 12.1 g/kW-hr for Class II engines (or 15.0 g/kW-hr NMHC+NOx for Class I natural-gas fueled engines and 11.3 g/kW-hr for Class II natural-gas fueled engines). However, all early credits would be calculated against the initial Phase 2 standards of 25.0 g/kW-hr HC+NOx for Class I engines and 18.0 g/kW-hr HC+NOx for Class II engines (or the corresponding NMHC+NOx standards of 23.0 g/kW-hr and 16.7 g/kW-hr, respectively, for natural-gas fueled engines). If the manufacturer certifies its product line to the proposed Phase 2 standards early through the use of averaging, the manufacturer could bank credits for use in 2001 and later, but could only bank credits from those engines which were not needed to show early compliance with the proposed Phase 2 standards. In other words, manufacturers would not be allowed to bank credits from engines whose credits were already used to offset other engines with FELs above the proposed Phase 2 standards. This would prevent manufacturers from “double counting” credits needed to show early compliance with the

proposed standards. Manufacturers would not be allowed to trade their early credits to other manufacturers until the 2001 model year or later.

In establishing the proposed set of declining standards for Class II engines, EPA assumed a certain phase-in of OHV or comparably clean and durable technology. As described in the March 1997 ANPRM, the proposed series of Class II HC+NOx standards were based on the assumption that 50 percent of Class II engines would employ OHV or comparably clean and durable technology in 2001 (i.e., could meet a 12.1 g/kW-hr HC+NOx standard without the use of credits). For the remaining years, the phase-in schedule assumed for "OHV emission performance" ("OEP") technology was 62.5 percent in 2002, 75 percent in 2003, 87.5 percent in 2004, and 100 percent in 2005. EPA believes this phase-in of OHV or comparably clean and durable technology is important due to the inherent emission benefits anticipated from this technology in use. Related to the concerns discussed above regarding credit life for pre-2005 credits, the Agency is concerned that manufacturers of Class II engines could bank early credits and use such credits to continue certifying a line of engine families that do not meet the OEP production phase-in schedule assumed by EPA in establishing the proposed standards. Therefore, EPA is proposing that manufacturers only be allowed to use early banked credits beginning in 2001 or later if they are meeting the OEP production phase-in schedule estimates for that model year. EPA believes prohibiting the use of early banked credits unless manufacturers meet such conditions will encourage the manufacturers to meet the OEP production phase-in schedule assumed in developing the proposed Phase 2 standards.

d. Cross-Class Exchange of Credits for Certification Purposes

Today's proposal contains limitations on the cross-class exchange of credits during certification. The limitations are meant to assure the ABT program fulfills its intended function of encouraging a transition to cleaner, more durable technology for both classes of nonhandheld engines and achieves the expected environmental benefits of the program. The proposed limitations are also intended to assure that the proposed ABT program does not affect competition between engine manufacturers.

With regard to encouraging cleaner, more durable technology, the proposed schedule of standards for Class II engines was established with the assumption that engine manufacturers will phase-in OHV technology over roughly the five year period from 2001 to 2005 based on the schedule noted earlier. In order to encourage manufacturers to follow the assumed OEP production phase-in schedule, EPA is proposing that limited cross-class exchange of credits for certification purposes, as noted below, would be allowed only if a manufacturer's Class II engine production meets or exceeds the assumed OEP production phase-in schedule for Class II engines presented earlier.

With regard to competition in the nonhandheld market, about two-thirds of nonhandheld engine manufacturers currently produce both Class I and Class II engines. The remaining one-third of the nonhandheld engine manufacturers produce only Class II engines. At this time, EPA is not aware of any nonhandheld engine manufacturers that only produce Class I engines. Allowing manufacturers to exchange credits across engine

classes could cause a competitive disadvantage for those manufacturers who only produce Class II engines because they would not have the advantage of being able to use positive credits from Class I engines. Therefore, with regard to the cross-class exchange of credits, EPA is proposing that manufacturers would be allowed to exchange credits from credit generating Class II engines to credit using Class I engines for certification purposes. However, due to the competitive concerns noted above, EPA is not proposing to allow the exchange of credits from credit generating Class I engines to credit using Class II engines for certification purposes.

e. Use of Credits to Address Nonconformity Determined After Certification

As noted elsewhere in today's notice, EPA is proposing a number of provisions that address post-certification compliance aspects of the proposed standards. In two specific cases, EPA is proposing to allow manufacturers to use credits from the certification ABT program to address noncompliance determined after the time of certification. As noted in the discussion on compliance, EPA does not believe that the typical type of enforcement action that could be taken when a substantial nonconformity is identified (i.e., an engine family recall order) would generally be workable for nonhandheld small SI engines given the nature of the nonhandheld market. Whereas handheld engine nonconformities after certification would be addressed through the use of in-use credits, EPA is not proposing an in-use credit program for nonhandheld engines, as discussed in Section IV.D.

Instead, EPA is proposing to allow manufacturers to use certification ABT credit to address two different types of nonconformance. First, manufacturers would be allowed to use ABT credits to offset limited emission shortfalls for past production of engines determined through the Production Line Testing (PLT) program as described in Section IV.D.2. of today's notice. Second, manufacturers would be allowed to use ABT credits to offset emission shortfalls from Class II OHV engines that arise as a result of an adjustment to deterioration factors originally determined through good engineering judgement, as described in Section IV.E of today's notice. Under the proposed provisions, manufacturers would be allowed to use all credits available to them to offset such emission shortfalls. EPA does not believe it is necessary to limit the use of cross-class credits for these situations. Allowing manufacturers to exchange credits from one class to another should not raise the same concerns with regard to new engine competition as noted earlier because the manufacturer is addressing a nonconformance problem for engines that have already been sold and used in the field for a significant period of time. EPA requests comment on the proposed provisions for using certification ABT credits to address nonconformance with the Phase 2 emission standards determined after certification.

EPA is not proposing to allow manufacturers to use ABT credits to remedy a past production nonconformance situation in the Selective Enforcement Audit (SEA) program. As described in today's notice, EPA is planning to primarily rely on the PLT program to monitor the emissions performance of production engines. However, in the case of nonhandheld engines only, manufacturers would in some cases have the option of

traditional SEA in lieu of PLT as a production line compliance program. In addition, SEAs could be conducted in cases where EPA has evidence of improper testing procedures or nonconformities not being addressed through PLT. As discussed in section IV.D.3, if EPA determines that an engine family is not complying with the standards as the result of an SEA, EPA plans to work with the manufacturer on a case-by-case basis to determine an appropriate method for dealing with the nonconformity. The option(s) agreed upon by EPA and the engine manufacturer may, or may not, include the use of ABT credits to make up for any "lost" emission benefits uncovered by the SEA.

As noted earlier, EPA solicits comments on all aspects of the proposed ABT program, including comments on the benefit of the program to manufacturers in meeting the proposed emission standards and any potential air quality impacts which might be associated with them.

6. Certification Fuel

The program for nonhandheld engines discussed in the March 1997 ANPRM specified that the proposed range for eligible certification fuels for Phase 2 would be the same as under Phase 1. The program for handheld engines in the ANPRM was silent on this issue. EPA received comment on the ANPRM that the continued use of Phase 1 certification fuels for Phase 2 testing is appropriate so long as the same fuel may be used to certify handheld engines under both EPA and CARB regulations.

EPA is proposing today that certification test fuel requirements for the Phase 2 program would remain the same as in the Phase 1 program, as specified at 40 CFR 90.308(b). While California "Phase 2" reformulated gasoline is not a proposed certification test fuel, EPA believes that continuation of the Phase 1 program for Phase 2 would continue to provide a means of harmonizing the Federal and California programs. As described in the February 1997 Draft U.S. EPA Small Engine Certification Guidance, Section X "Certification Fuel", manufacturers have four options for choice of certification fuel for Phase 1[32]; EPA is proposing that these options would continue for this rule.

The first option is to use average in-use gasoline specified at 40 CFR Part 90, Subpart D, Appendix A, Table 3. The second option is federal certification fuel (e.g., Indolene), specified at 40 FR 86.1313-94(a), Table N94-1. Third, manufacturers may use other fuels, such as natural gas, propane, methanol, or others, under conditions described at 40 CFR 90.308(b)(2) and (3). Fourth, manufacturers may request EPA approval for certification testing on fuels such as California "Phase 2" reformulated gasoline, which do not meet the requirements for "other fuels" under 40 CFR 90.308(b)(2) or (3). For this option, manufacturers would request EPA approval of an alternate test procedure (e.g., alternate test fuel) under 40 CFR 90.120(b)(1). Manufacturers may elect to use an alternative test procedure provided it yields results equal to the results from the specified

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[32]See "U.S. EPA Small Engine Certification Guidance, Draft, February 19, 1997," available in EPA Air Docket A-96-55, Item #II-C-03.

test procedures (e.g., test fuels described at 40 CFR 90.308(b)), its use is approved by EPA, and the basis for equivalent results is fully described in the manufacturer's certification application (see 40 CFR 90.120(b)(1)). EPA would work with manufacturers to assist them in making the required technical demonstrations to show equivalency of the emission results. The continuation of these Phase 1 certification fuel requirements would continue to provide mechanisms for manufacturers to use the same fuel for certification to both EPA and California Air Resources Board regulations, as specified above.

B. Test Procedures

Test procedures are contained in today's proposal which would be used by engine manufacturers for the purpose of measuring emissions and determining emission rates for regulated emissions for certified engines. The test procedures being proposed today are in most respects identical to the procedures required for the certification of Phase 1 engines. Test procedures were discussed during the Regulatory Negotiation process, with the key issue being the appropriateness of the Phase 1 test cycles for Phase 2 engines. The draft Regulatory Support Document for this proposal contains a summary of the test procedure issues addressed during the Regulatory Negotiation process.

In general, the Agency believes the Phase 1 test procedures are appropriate for measuring engine emissions from Phase 2 engines.[33] In today's action, EPA is proposing the Phase 1 test procedures with the following minor changes. First, nonhandheld engines sold with an engine rotational speed governor would have to use the governor for speed control while running the appropriate test cycle. Second, the mode weightings for the handheld test cycle, Cycle C, would be adjusted to 0.85 for Mode 1 and 0.15 for Mode 2. Finally, appropriate changes to the test procedure and emission calculations have been proposed for the measurement of methane from natural gas fueled engines in order to determine non-methane hydrocarbon emissions for natural gas fueled nonhandheld engines. These proposed changes are discussed below. EPA requests comment on these issues.

1. Test Cycle: Requirement for the Use of a Speed Governor Operation for Testing of Nonhandheld Engines

Many small engines manufactured today make use of a speed control governor ("governor") to regulate engine rotational speed. In general, the governor is a mechanically or electronically controlled device that attempts to maintain engine rotational speed in a particular range as the engine experiences different loads. A typical

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[33]For a discussion on the adequacy of the Phase 1 test procedure, see Chapter 1.1 in "Regulatory Support Document, Control of Air Pollution, Emission Standards for New Nonroad Spark-Ignition Engines At or Below 19 kilowatts" U.S. EPA, May 1995, EPA Air Docket A-93-25, Item #V-B-01.

example is the walk-behind mower, where the governor is designed to control engine throttle position in response to various loads to maintain the engine's rotational speed, and thus, mower blade rotating speed, to provide an adequate grass cut. For the Phase 1 test procedure, manufacturers are allowed to over-ride or disconnect the speed governing device and use an external piece of equipment, i.e., a throttle controller, for the purpose of replicating the speed and load conditions required by the test cycle (see 40 CFR 90.409(a)(3)). After the finalization of the Phase 1 rule during the regulatory negotiation process, the Test Procedure Task Group formed by the Regulatory Negotiation committee recognized that the use of the engine's designed governor, not an external throttle controller, may be a more accurate prediction of an engine's in-use performance. The Test Procedure Task Group members generally agreed that a Phase 2 test procedure should require the use of the engine's speed governor for speed control during the Federal Test Procedure (FTP) for those engines which are equipped by the manufacturer with a speed governor. However, there was not general agreement or detailed discussion of the specific requirements of how the speed governor should be used during the FTP. At this time the Agency believes the most appropriate method to operate engines on the speed governor for an emissions test would be to use fixed throttle operation for the 100 percent load mode, and then to use the engine governor for all subsequent power modes (75 percent, 50 percent, 25 percent and 10 percent). For each power mode, the engine speed governor set-point would be adjusted to the nominal test cycle set-point, 85 percent of rated speed for Cycle A, and 100 percent rated speed for Cycle B. This test method allows for a consistent and repeatable method of determining the 100 percent load condition, yet would allow the engine's governor to regulate speed for the remaining load conditions. This method is also straightforward and would be relatively simple to implement in a laboratory. The Agency requests comment on this test method and on other test methods which may be more appropriate.

2. Test Cycle: Adjustments for Weightings for 2-mode Cycle for Handheld Engines

The Agency is proposing a change in the weighting factors for the handheld test procedure. For the Phase 1 rule, a weighting factor of 90 percent is applied to the 100 percent power mode, and a factor of 10 percent is applied to the idle mode, in order to combine the modal results for the final weighted emission value. The Agency is proposing for Phase 2 that a weighting factor of 85 percent is used for the 100 percent power mode, and 15 percent be used for the idle mode. This proposal is based on a study performed by members of PPEMA during the regulatory negotiation process.[34] PPEMA members collected real-time speed and throttle position data on several types of handheld equipment used during actual in-use operation. This data was analyzed and combined with estimates of annual use, load factors, and annual sales to weight the results of the

[34]See "Hand Held Composite Duty Cycle Report", February 1995, prepared by members of the Portable Power Equipment Manufacturers Association, available in EPA Air Docket A-96-55, Item # II-D-18.

field testing. EPA's summary of this report is contained in the Draft RSD. The Agency agrees with the report's conclusion that a more appropriate set of weighting factors for handheld engines is 85 percent for the 100 percent power mode and 15 percent for the idle mode. Therefore this change is being proposed for Phase 2.

3. Measurement of NMHC Emissions from Natural Gas Fueled Nonhandheld Engines

In order to accommodate the proposed optional non-methane hydrocarbon (NMHC) standard for natural gas fueled nonhandheld engines, the Agency is proposing to incorporate by reference the appropriate sections from 40 CFR Part 86 which relate to the measurement of methane emissions from spark-ignited engines. These appropriate sections were published as part of a final rulemaking titled "Standards for Emissions From Natural Gas-Fueled, and Liquefied Petroleum Gas-Fueled Motor Vehicles and Motor Vehicle Engines, and Certification Procedures for Aftermarket Conversions" see 59 FR 48472, published on September 21, 1994. The specific sections being incorporated can be found in the proposed regulatory language contained in this proposal at §90.301(d) and §90.401(d).

C. Field/Bench Adjustment Program

The ANPRM contemplates a so-called "bench field correlation program" for both handheld and nonhandheld small spark ignited engines.[35] For handheld engines, it is part of the in-use testing program (ANPRM, Appendix A, Section J(2)); for nonhandheld engines, it is part of the certification program (ANPRM, Appendix B, Sections 4(a) and (b)). In either case, the basic premise for these programs is the same: to allow manufacturers to age engines on the bench to demonstrate expected compliance in-use, it is necessary to demonstrate the "correlation" between field aging and bench aging.

The ANPRM sets out slightly different requirements for the proposed handheld and nonhandheld programs. Specifically, the ANPRM stipulates that the handheld correlation program would be conducted under EPA guidance; a portion of the engines would be aged in situations in which the manufacturer does not exercise control over the engines' maintenance, or limit their usage such that the engines are no longer used in a way that is representative of typical in-use engines; the full federal test procedure would be used; all pollutants would be measured; residential engines would be aged to their full regulatory life but commercial engines could be aged to 75 percent of their full regulatory life; samples sizes would be determined in the NPRM process; and there would be periodic spot checks of the correlation (ANPRM, Annex A, Section J(2)).

The ANPRM provisions for the nonhandheld engines are less comprehensive. For

[35]The use of the term "correlation" was meant to describe an adjustment factor that can be applied to bench-aged engines to approximate field-aged conditions, and not a true statistical correlation.

this category, the correlation program was specifically discussed for engines using side-valve or aftertreatment technologies. In addition, the ANPRM describes a simple "correlation" method (ratio of mean emission rates); would require periodic re-calculation (every other year for the first five years of the program and then every five years thereafter, e.g., 2001, 2003, 2005, 2010, 2015, etc.); and calls for changes in the correlation to apply prospectively only.

In today's NPRM, EPA is proposing a unified program, to be called the "field/bench adjustment program,"[36] that would apply to both nonhandheld engines that use side-valve or aftertreatment technologies and to handheld engines. EPA believes it is appropriate to design one program to apply to both categories of engines both because it is less complicated for manufacturers that produce both kinds of engines and because it simplifies the compliance program for administrative purposes. EPA seeks comment on the application of the same program and methodology to both categories of engines. The remainder of this section will set out the background for field/bench adjustment and the principles of such a program, a proposed methodology, and various practical requirements for the application of the program. It will end with a brief discussion of an alternative methodology.

1. Background and Principles

There are at least three ways to demonstrate compliance with in-use standards such as those proposed in today's rule. In general, the most representative way is to demonstrate compliance on engines that have been aged to their full regulatory lives by actual end-users. This ensures that the emissions reflect actual in-use conditions, including the presence of dirt and other matter such as clippings, operation at several degrees of orientation, operation in very hot ambient temperatures, etc. At the same time, consumer-based field aging is difficult, not the least because it is cumbersome to organize a program with a sufficient number of end-users. In addition, it may take some end-use consumers years to put an appropriate number of hours on the engine through normal use.

The second method is to demonstrate compliance on engines that have been aged to their full regulatory lives on the bench. While this method can be more practical for the manufacturer, it also abstracts away many operational or environmental conditions that can affect deterioration.

The third way, and the way being proposed in today's notice, is a consolidation of some elements of the other two methods. Under it, manufacturers could bench age engines and then adjust the emission test results to reflect actual in-use conditions as represented by field aging. This would be accomplished by developing a field/bench adjustment factor that would be applied to emissions from bench-aged emissions to simulate field aging.

Thus, the objective of this field/bench adjustment program is to develop an

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[36]This nomenclature more accurately reflects the purpose of the program.

adjustment factor based on the mathematical relationship between emissions from field-aged and bench-aged engines. For obvious reasons, it is very important to design a field/bench adjustment program that will yield an adjustment factor that is as closely related as possible to the true relationship between field and bench aging. Any deviation will result in an adjustment factor that either under-corrects or over-corrects the bench results, the ultimate result being an impact on the stringency of the emission limits. In addition, this field/bench adjustment program should take advantage of statistical techniques, both to take into account the inherent uncertainty in sampling[37] and to allow EPA to impose some restrictions on the use of this simplified compliance method. In today's notice, EPA is proposing to allow manufacturers to use the simple ratio of the field and bench mean emission results as an adjustment factor if the width of a confidence interval around the bench-aged and field-aged mean emission rates does not exceed a certain percentage of the standard. This restriction would limit the emission results for each sample, permitting a closer fix on the true population relationship.

2. General Methodology

Drawing on the elements of the "bench field correlation program" set out in the ANPRM and the criteria discussed above, EPA is proposing the following methodology to calculate the adjustment factor that would be applied to bench-aged emissions to approximate field aging. EPA seeks comments on all aspects of this program.

Two samples of engines would be aged, one in the field and one on the bench. The aging procedures for all engines in the field sample would be the same, and the aging procedures for all engines in the bench sample would be the same. The manufacturer would develop a test plan which would specify the conditions under which the engines would be aged on the bench and in the field. EPA would reserve the right to review any test plan, for handheld or nonhandheld engines, and to require the manufacturer to revise it if it does not reflect appropriate testing conditions. This review would enable EPA to exercise some oversight of the program without requiring the entire program to be performed under EPA guidance, as anticipated in the handheld program described in the ANPRM. With regard to sample size, today's proposed program contains only two constraints: the bench-aged and field-aged samples must initially be of equal size and must contain at least three engines. This minimum number is necessary to perform the statistical tests described below.

Next, each engine would be tested on the full federal test procedure after it has been run for its useful life. Then, for each sample, the mean HC+NOx emission rate would be calculated and two independent confidence intervals would be constructed, one

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[37]To take full advantage of the field/bench adjustment program, engine manufacturers will presumably prefer to bench and field age only a relatively small number of engines. Thus, the results of the program will heavily depend on the characteristics of the sample (it is generally the case that a different sample would have different emission results and a different adjustment factor).

around the mean of the field-aged engines, and one around the mean of the bench-aged engines, using the student's T distribution and a 90% confidence level.[38] The width of each confidence interval would then be compared to the "maximum allowable interval width" proposed today. EPA is proposing +/-20% of the standard as the maximum allowable interval width. If the confidence intervals around each of the field-aged and bench-aged means each are no wider than the maximum allowable interval width (e.g, +/-20 % of the standard), then the adjustment factor that would be applied in the future to bench-aged engines to simulate field aging would be the ratio of the means ($\bar{x}_F/\bar{x}_B$), *provided* this ratio is greater than or equal to one.

EPA is proposing that these constraints be applied to both handheld and nonhandheld engines, but seeks comment as to whether the confidence levels and maximum allowable interval widths should be different among them. EPA chose 90% confidence levels for constructing the confidence intervals for the field-aged and bench-aged engines, and +/-20% of the standard maximum allowable interval widths, based on computer simulations[39] ; however, manufacturers or others commenting on this proposal may have information that suggest other levels.

Under the proposed program, if either or both of the confidence intervals do not pass the above-described statistical test, the manufacturer would have the choice of three remedies. First, the manufacturer could increase the size of the failing sample and repeat the statistical tests with the increased number of engines. Often, increasing the size of the sample will lead to a smaller sample variance, although this is not always the case with small samples. A manufacturer could repeat this remedy as many times as desired. Note that it would not be necessary to increase the size of both samples; only the sample that failed the statistical test would need to be increased. Alternatively, if the statistical tests are failed, the manufacturer could adjust the test plan and rerun the program, subject to EPA approval. In the third alternative, the manufacturer could choose to age all engines in the field for the purposes of the compliance program.

3. Practical Requirements of the Program

This section describes several practical elements of this proposed field/bench adjustment program and how it would work if adopted as proposed.

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[38]The formula for the confidence interval would be

$$\bar{x} \pm t_{(1-\alpha/2;\ n-1)} * s/\sqrt{n}$$

where

$\bar{x}$ is the sample mean

$t_{(1-\alpha/2;\ n-1)}$ is the appropriate parameter from Student's t table, depending on the level of confidence chosen by EPA

s is the sample standard deviation

n is the number of engines in the sample

[39]See "Simulation to Determine Confidence Level and Maximum Allowable Interval Width for Field/Bench Adjustment Factor Program," EPA Air Docket A-93-29, Item #II-B-01.

a. Initial Field/Bench Adjustment Factor Calculation

The ANPRM does not discuss an initial date by which the first correlation would have to be performed, and thus the first adjustment factor calculated. EPA is today proposing that a manufacturer may propose a field/bench adjustment program test plan up to 48 months prior to certification for Phase 2, and if EPA did not reject the proposed test plan within 90 days of submission of a complete test plan, the proposed test plan would automatically be accepted. EPA is also proposing that, at least 90 days before beginning bench aging for certification or in-use testing purposes, the manufacturer would provide a report to EPA for approval describing the aging and testing conducted for the field/bench adjustment program. This timing would ensure that adjustment factors have been established in time for demonstrating compliance with Phase 2 standards. EPA is also proposing that the initial field/bench adjustment program be performed on engines representative of Phase 2 engines.

b. Periodic Rechecks

The ANPRM contemplates that both the handheld and the nonhandheld correlation programs would require the correlation to be periodically rechecked, although only for the nonhandheld engines was a specific recheck schedule provided (every other year for the first five years of the program and every five years thereafter, e.g., 2001, 2003, 2005, 2010, 2015, etc.). In today's notice, EPA is proposing that the recheck period be the same for both handheld and nonhandheld engines. However, EPA suspects that the recheck period described in the ANPRM's nonhandheld program may be more comprehensive than is necessary. Specifically, it may be the case that the field/bench adjustment factor will not need to be checked so often, especially if technologies, production tolerances, and emission results do not change that much from year to year. As a result, EPA is proposing that the field/bench adjustment factor be re-estimated as often as every five years as determined by EPA on a case-by-case basis, except that EPA may require more frequent rechecks in model years prior to the 2006 model year. EPA seeks comment on this proposed recheck schedule. EPA also proposes that any new adjustment factor subsequent to a recheck be applied regardless of how similar it is to the adjustment factor from the previous correlation effort. However, the new adjustment factor would apply only prospectively, beginning with the next model year. EPA seeks comment on whether a longer lead time should be specified, for example requiring the new adjustment factor to be applied with the engine model being certified at least six months after the new adjustment factor is determined. This would allow more time for engine manufacturers to adjust their designs, if necessary. Finally, EPA is not proposing any restrictions on the direction of modification of the field/bench adjustment factor that may results from future rechecks: it could be revised up or down, but not below 1.0.

c. Hours to Age

EPA is proposing that all bench-aged engines be aged to their full regulatory lives.

Field-aged nonhandheld engines and field-aged residential handheld engines would also be aged to their full regulatory lives. However, following the program described in the ANPRM, under the proposed program field-aged commercial handheld engines could be field-aged to a minimum of 75 percent of their full regulatory lives. This flexibility is proposed today to reflect concerns that it may be hard to age these engines in the field due to equipment problems not related to emissions and engine durability which might be experienced at the end of the useful life. At the same time, as described below, field aging need not be done by actual end users but, instead, could be done by the manufacturer using a test plan that mimics as closely as possible actual field use. Under these conditions, the equipment may be less likely to break. Field aging to a minimum of 75 percent of regulatory useful life is being proposed as a cost savings measure for commercial engines which have the longest regulatory useful lives. Furthermore, EPA believes that test results on commercial engines aged to at least 75 percent of their regulatory useful lives can be appropriately extrapolated to the full regulatory useful life of the engine due to the generally more durable design of commercial engines which would tend to result in more predictable emission determination performance. Therefore, EPA seeks comment on the costs and benefits associated with field aging handheld commercial engines to their full regulatory lives. Finally, EPA is proposing that all engines in the same sample (bench or field) be aged to the same number of hours.

d. Test Plan

EPA is proposing that the manufacturer develop a test plan for both field and bench aging. All such test plans would be required to use the federal test procedure. The handheld program described in the ANPRM specified that "a portion of the field engines will be aged in individual usage or fleets where the manufacturer does not carry out or exercise control over the engines' maintenance, or limit their usage such that engines are no longer used in a way that is representative of typical in-use conditions." Manufacturers would have three ways to field-age engines: in individual usage, in an independent fleet, or in a fleet that may be controlled by the manufacturer but over which the manufacturer does not control the maintenance process or inappropriately limit use. EPA proposes to extend this choice to both handheld and nonhandheld engines. However, EPA proposes that, if the manufacturer chooses to field-age the engines in a non-independent fleet, the applicable test plan must explain how the engines will be used to approximate, as closely as possible, actual in-use conditions, and also the kind of maintenance program to be followed, which should approximate expected in-use maintenance by end-users. The key is to ensure that the engines will experience similar load demands and environmental factors. For example, in the case of lawn mowers, the test plan for a non-independent fleet would have to specify how the engine would be exercised in a way to be representative of typical in-use conditions, which likely include cutting both high and low grass, under wet and dry conditions, etc. Alternatively, if the manufacturer chooses to age the engines in an independent fleet, the test plan would have to detail how the use of the engine will be documented and how the user will ensure that it is used in a variety of different conditions. Finally, EPA could review this test plan and

could require changes if the plan does not adequately approximate in-use conditions.

e. Technology Subgroups

For both individual-manufacturer and industry-wide programs (see f., below), the analysis could be done on engine technology subgroups which could be expected to have similar emission deterioration characteristics, that is, groups of engine families from one or more manufacturers having similar size, application, useful life and emission control equipment. It would not be appropriate for engines with significant differences in in-use emissions performance characteristics to be included in the same technology subgroup. Manufacturers would be required to provide a justification satisfactory to EPA that the engines families would be expected to have similar emission deterioration characteristics, and would thus be appropriately grouped in the same technology subgroup.

f. Individual-Manufacturer or Industry-Wide Estimation.

EPA is proposing that the above-described field/bench adjustment program and estimation of the field/bench adjustment factor can be performed on either an individual-manufacturer basis or on an industry-wide basis. Any manufacturer who wants to use a field/bench adjustment factor instead of field aging engines would have to either conduct its own program, or participate in an industry-wide program. In other words, the engines that will benefit from the application of an adjustment factor would have to be included in the sample used to estimate that adjustment factor. This requirement would ensure that a manufacturer could not simply apply a field/bench adjustment factor estimated by another manufacturer that may not reflect the performance of the engines to which it is applied.

An industry-wide analysis would be subject to several additional constraints. First, EPA is proposing that all manufacturers participating in the same sample use the same test plan, except that maintenance schedules could vary across manufacturers to reflect differences in manufacturer-specified maintenance guidance to end-users. This is to reflect the fact that although manufacturers may pool their emissions results in the industry-wide program, they may want to test their engines separately. This uniformity is important to avoid biased aggregation of results. Second, the sample of engines used to estimate the field/bench adjustment factor would have to include at least one bench engine and one field engine from the same engine family from each participating manufacturer, but no fewer than three bench-aged engines three field-aged engines per technology subgroup. EPA seeks comment on whether the emissions should be sales weighted, to give a better picture of emissions across the category. EPA requests comment on how such a sales weighting procedure could be accomplished and still protect the confidentiality of sales information that might be covered by the confidential business information provisions of 90 CFR part 2. Third, EPA proposes to limit entries into and exits from the industry-wide program: a manufacturer could enter or drop out only before the adjustment factor goes into use for the first time. This will prevent constant revision of the adjustment factor. If a manufacturer drops out of the industry-

wide adjustment program, the field/bench adjustment factor would have to be recalculated, both for that manufacturer and the industry. This is necessary to ensure that the field/bench adjustment factor reflects only the experience of the engines to which it will be applied. Presumably, a manufacturer will drop out only if its individual adjustment factor is more favorable than the industry-wide adjustment factor. Thus, if the industry-wide adjustment factor is not recalculated, then it will understate the experiences of the engines to which it will be applied. EPA seeks comment on whether such restrictions are necessary.

g. Restriction on Using Test Results for Other Purposes.

One comment on the ANPRM requested that engine manufacturers be allowed to combine certification, correlation, and in-use testing for a family, such that bench results from the bench aged engines from the field/bench adjustment program can be used to satisfy in-use testing requirements. EPA proposes to allow test results from engines used for the field/bench adjustment program to be considered for purposes of determining handheld deterioration factors based on good engineering judgment. EPA believes this is appropriate because in the handheld certification program compliance is determined by applying a deterioration factor to new engines. Thus, the actual engines that are used for certification are not the field-aged engines. However, the test results from the field/bench adjustment program would not be acceptable to satisfy the in-use testing requirements for handheld engines, since this would create a situation in which engines that were used to estimate a parameter for the compliance program are also used to demonstrate compliance. Similarly, EPA would not allow the test results from the field/bench adjustment program to be used for demonstrating certification for the nonhandheld program. The nonhandheld engine compliance program relies on emission results from engines aged to their full regulatory lives. As in the handheld engine in-use testing example above, if the engines used in the field/bench adjustment program were also allowed to be used to demonstrate compliance, this would create a situation in which engines that were used to estimate a parameter for the compliance program are also used to demonstrate compliance. Finally, EPA proposes to prohibit emission results from engines tested to determine compliance with other parts of today's program from being used for purposes of calculating the field/bench adjustment factor. This restriction is necessary because otherwise manufacturers could choose among all of their test results and submit only the best emission results from a fairly large pool of engines, thus biasing the field/bench adjustment calculation. EPA does not believe this restriction will be burdensome, since manufacturers will be able to estimate a field/bench adjustment factor with as few as two engines (one bench-aged, one field-aged) if they participate in an industry-wide program, or six engines (three bench-aged and three field-aged) if they decide to establish their own adjustment factor.

h. Other Pollutants.

The handheld program described in the ANPRM contemplated that all pollutants

be measured. EPA is proposing that CO emissions be measured and adjustment factors for CO be determined for both the nonhandheld and handheld programs. However, EPA believes that the data set upon which statistical tests used to establish appropriate adjustment factors for HC+NOx are determined are sufficient to establish the relationship between CO emissions in the field and on the bench. Therefore, EPA proposes to allow manufacturers to use the same set of data to calculate a CO adjustment factor as would be used to establish the HC+NOx field/bench adjustment factor. EPA requests comment on this proposal.

4. Alternative Methodology Considered

EPA believes that the methodology described above is most appropriate because it balances the desires of industry for a simple program with the desire of EPA to put reasonable statistical constraints on the program without making it too difficult to perform or apply. However, there are other methods that can be used. Notably, EPA considered a statistical methodology in which a confidence interval would be constructed around the ratio of the means, and the adjustment factor would be the upper bound of that confidence interval.[40]

While both techniques attempt to apply statistical concepts, this alternative methodology could be considered in some ways more statistically sound than the one proposed above. However, it may be practically more difficult to use. Most importantly, the adjustment factor derived from this alternative methodology would be sensitive to the number of engines tested: a larger number of engines will most often result in a smaller adjustment factor, although this need not always be the case. Thus, manufacturers will be faced with either testing a large number of engines to ensure the smallest adjustment factor (closest to the straight ratio of the sample means) or using a larger adjustment factor with concomitant effects on the adjusted emission rate. EPA is concerned that this dynamic could lead manufacturers to test a large number of both bench-aged and field-aged engines. In addition, the adjustment factor derived from this alternative methodology will always be a conservative estimate of the relationship between bench and field-aged results, because it is the upper bound of the confidence interval, and it will always be greater than the simple ratio of the means. Yet, it is not clear why choosing a conservative adjustment factor is preferable to a simple ratio of the sample means. Nevertheless, EPA seeks comment on the use of this methodology and other alternative approaches as opposed to the proposed methodology.

D. Compliance Program

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[40]See "Simulation to Determine Confidence Level and Maximum Allowable Interval Width for Field/Bench Adjustment Factor Program," EPA Air Docket A-93-29, Item #II-B-01. For a description of this alternative approach, see "A Procedure for Adjustment of Emissions Results for Bench Aged Small Engines," located in EPA Air Docket A-96-55, Item #II-D-40.

This section discusses the three step compliance program proposed today for the Phase 2 regulation of small SI engines, consisting of certification, production line testing, and in-use emission testing. As discussed above in Section III, today's proposal contains three basic elements new to the Phase 2 program. First, manufacturers would be required at the time of certification to account for emissions deterioration throughout the useful life of the engines. Second, EPA is today proposing a manufacturer-run production line testing program to replace the existing Selective Enforcement Audit (SEA) program as the primary method of determining the compliance of new production engines. Finally, EPA is proposing in-use emission testing programs for nonhandheld and handheld engines. EPA is also proposing appropriate remedies to address noncompliance with emission standards. Such remedies include mandatory recall but would also consider alternatives to mandatory recall, in the event of nonconformities found through production line testing or in-use testing programs. The basic proposed program for nonhandheld and handheld engine compliance is described in this section; Section IV.E outlines certain compliance flexibilities which may be made available to certain manufacturers depending on a manufacturer's size, the class of engines, or other factors.

1. Certification

The certification process as required in the Act is an annual process. The Act prohibits the sale, importation or introduction into commerce of regulated engines when not covered by a certificate. The certification process proposed in this notice differs from that required in Phase 1 in that it would require the manufacturer to demonstrate that the engines will meet standards throughout their useful lives. To account for emission deterioration over time, manufacturers would be required to either age engines out to their full useful lives to obtain certification, or to adjust their certification test results by assigned or calculated deterioration factors (dfs), as is currently done under other EPA mobile source rules. Where appropriate and with suitable justification, dfs would be allowed to be carried over from one model year to another and from one engine family to another. This section describes nonhandheld and handheld engine certification provisions, provisions for certification to CO standards, and EPA efforts to streamline the certification process.

a. Nonhandheld Certification

This notice proposes that certification for Class I and Class II nonhandheld engines continue as in Phase 1 except for the inclusion of an estimation of in-use deterioration. This deterioration estimate would be used to predict full useful life emission performance which would then be the basis for certification compliance decisions. The method for estimating in-use deterioration for certification purposes would depend on the type of engine technology.

i. Side-Valve Engines and Engines with Aftertreatment

For all side-valve engines and engines with aftertreatment, this notice proposes that one engine from each engine family would either be field aged in a representative application to its full useful life, or bench aged to its full useful life to demonstrate compliance with the standards.[41] If a manufacturer chose the bench aging option, it would be required to use a bench cycle approved in advance by the Administrator, adjusting the results using the field/bench adjustment factor established through the process described above at Section IV.C. In either case, the manufacturer would be required to run the full test procedure described in this rule when the engine is stabilized, accumulate hours on the engine, and then run a full test procedure at full useful life hours to determine a test value for certification.

The final field-aged results or the final adjusted results of the fully bench-aged engines would be compared against the applicable standard to determine compliance at the time of certification. In addition, a df would be calculated from the final test results compared against low hour stabilized test results. While not directly used in the certification program, this df would be used to adjust the results of engines tested in Production Line Testing program described below in Section IV.D.2.

For Class II SV engines and Class II engines with aftertreatment certified to the 250 hour useful life category, the manufacturer would have the option to bench age the engine to less than the full useful life and calculate a df at the engine's full useful life using a method of data extrapolation acceptable to the Administrator, as described below in Section IV.E.

ii. Overhead Valve Engines

As discussed elsewhere in this notice, EPA expects the Phase 2 rule to result in a virtually complete technological shift for Class II nonhandheld engines from SV to OHV or comparably clean and durable technology engines. In addition, EPA believes that OHV technology engines have the potential to show low and stable emissions deterioration characteristics as compared with SV technology engines.

EPA is today proposing that manufacturers of OHV technology engines be allowed to use an industry-wide assigned df for certification purposes. This program should allow manufacturers to focus more of their efforts on transitioning to a cleaner technology, by reducing the certification test burden on the engine manufacturers at the beginning of the Phase 2 program. EPA believes that offering manufacturers the opportunity to use an industry-wide assigned df rather than calculated dfs is reasonable for OHVs. A key element of the proposal for an assigned df is the proposed requirement that all manufacturers of OHV technology engines would participate in an industry-wide OHV Field Durability and In-use Performance Demonstration Program ("Field Durability Program") described in Section IV.D.3, below. This program would be designed to

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[41]For nonhandheld engines participating in the averaging, banking and trading program described in more detail above in Section IV.A.5, compliance would be demonstrated with the family emission limit (FEL) rather than the standard.

demonstrate the validity of the assigned df by producing significant amounts of data from real field-aged engines. If the OHV Field Durability Program data indicate that the assigned df is inappropriate, EPA would conduct a rulemaking to modify these proposed provisions to correct the assigned df program. This section describes the assigned df program for OHV engines, as well as an option for manufacturers to calculate dfs through field testing engines at the time of certification.

Assigned dfs For OHV Nonhandheld Engines

EPA is proposing that manufacturers of OHV technology engines would be allowed to use a multiplicative assigned df of 1.3 for OHV engines in all useful life categories for projecting emissions deterioration for compliance purposes. In the ANPRM, EPA discussed a value of 1.3 as the assigned df value for Class I and Class II OHV technology engines in the shortest useful life categories (i.e., 66 and 250 hours, respectively). In addition, EPA indicated that it would consider during the rulemaking process whether or not to propose an assigned df for all useful life categories, and if so, what the appropriate assigned df values would be. EPA indicated that the assigned df for Class II OHVs in the 500 and 1000 hour useful life categories would likely fall between 1.3 and 1.5. In addition, if an assigned df of 1.5 at 1000 hours, for example, appeared to be the appropriate value, EPA would propose a standard for the 1000 hour category adjusted by ratio to the proposed 12.1 g/kW-hr standard proposed for the 250 hour category.

EPA received comment on the ANPRM that the assigned df should be higher than 1.3 for the higher useful life categories, with a corresponding higher emission standard for the higher useful life categories. This commenter suggested that the application of a 1.3 df to longer useful life periods could reduce product offerings and impose unjustified costs on small equipment manufacturers. EPA received a similar recommendation for higher dfs for the 500 and 1000-hour useful life categories.[42] Specifically, an assigned df of 1.4 and a HC+NOx compliance standard of 13.0 g/kW-hr were recommended for 500-hour engines and an assigned df of 1.5 and a HC+NOx compliance standard of 14.0 were recommended for 1000-hour engines. In making these recommendations, the represented manufacturers argued that EPA had no full life emission performance information for these categories of engines. Although acknowledging they were providing no data to substantiate their recommendation, these manufacturers believe these higher dfs and emission standards provide a better assessment of equivalent stringency for these categories of engines compared to 250-hour engines certified with a 1.3 df to a 12.1 g/kW-hr standard.

EPA also received comment that use of assigned dfs should be limited to small volume manufacturers as a cost savings measure, and that the use of experimentally-derived dfs is preferable to the use of assigned dfs. This commenter argues that if the

[42]See Memo to the Docket regarding the October 3, 1997 meeting between U.S. EPA and the Engine Manufacturers Association, EPA Air Docket A-96-55, Item #II-E-11.

assigned df level is set too high, it could penalize those manufacturers who develop extremely durable engines, but if an assigned df were set too low, the result could be an underestimation of the emissions impact associated with an engine family or even the entire category. A final commenter asserted that assigned dfs are a bad idea; that the program described in the ANPRM results in a program in which future standards are uncertain due to the possibility of another rulemaking to adjust dfs; and that in the interval, engines may exceed the in-use standards because there is little incentive for manufacturers to reduce the deterioration rates of their engines.

EPA believes an industry-wide assigned df combined with the OHV Field Durability Program to validate assumptions as to the durability of OHV technology engines is a sound program. The Agency fully expects the assigned df to accurately reflect the industry-wide average df of OHV engines certified to the proposed standards at least in the near term. As manufacturers gain improved capabilities to produce OHV engines (as would be expected as an increasing proportion of small engines become OHVs), the industry-wide df could shift to a lower value. There is no expectation, however, for a shift to a higher average df. The OHV Field Durability Program is expected to yield significant quantities of in-use data designed to verify the assumptions as to the emissions durability characteristics of OHV technology engines underlying today's proposal. The future standards are not uncertain if the industry average assigned dfs prove to be low and stable, as anticipated by this proposed rule.

EPA is today proposing a 1.3 assigned df for all useful life categories for Class I and Class II engines, based on EPA analysis of available test data on engines aged in the field, provided by engine manufacturers.[43] While the data are limited, the data on Class II engines designed for longer useful life periods do not point to any value other than 1.3 for an assigned df for longer useful life hours. While no data were available on Class I engines designed for longer useful lives, EPA believes that a 1.3 assigned df at longer useful lives is a reasonable value. Longer useful life engines are designed for enhanced durability, and this is reflected in the emissions deterioration of the engines as well, with longer useful life engines experiencing the same emissions deterioration at longer hours as do short useful engines at short hours. Additional information on the derivation of the proposed assigned df of 1.3 is contained in the docket to this rulemaking.[44] Commenters who suggested a value other than 1.3 for assigned dfs at longer useful life hours did not supply data in support of their recommendations. However, EPA recognizes that the data upon which this proposal is based are very limited. EPA requests additional data on which to base the analysis for determining values for assigned dfs for OHV engines at longer useful lives. In particular, EPA requests comment on and any data supporting the assigned df and level of standards recommended by engine manufacturers (that is, 1.4 df

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[43]See "Tier 1 Deterioration Factors for Small Nonroad Engines", September 1996, a report by Air Improvement Resources, available in EPA Air Docket A-96-55, Item #II-D-11.

[44]See "Summary of EPA Analysis of Nonhandheld Engine HC and NOx Exhaust Emission Deterioration Data for 500 Hour Useful Life Class II OHV Engines," EPA Memorandum, August 4, 1997, available in EPA Air Docket A-96-55, Item #II-B-02.

and 13.0 g/kW-hr for 500-hour engines, and 1.5 df and 14.0 g/kW-hr for 1000-hr engines).

Finally, EPA is concerned that an industry-wide assigned df could reduce the incentive for a manufacturer to improve the durability of its engines. If manufacturers would be able to rely on an assigned df for certification performance regardless of in-use emission performance, manufacturers could design and produce engines which actually had much higher in-use deterioration than the assigned df. Manufacturers would be motivated to do so if they receive cost or other advantages from such a strategy. This is a real possibility since, in general, less expensive designs such as those with larger production tolerances or no oil control rings would also be expected to have higher emission deterioration. To protect against this, EPA is proposing limits on the use of assigned dfs. Specifically, EPA is proposing that if it determines the manufacturer's actual in-use sales weighted average df for a useful life category (e.g., all OHV families certified to a 500-hour useful life) exceeds the assigned df by more the 15 percent (i.e., actual in-use df is 1.5 or greater), then EPA may require the manufacturer to generate engine family-specific dfs for one or more engine families in that useful life category. Similarly, if EPA determines that a family has an actual in-use df greater than 1.8, then EPA may require the manufacturer to generate an engine-specific df for that family. In either case, if EPA requires such engine-specific dfs, they would be determined on the basis of data from three field-aged engines per engine family. This level of testing is the same as that for the program being proposed for a manufacturer which opts to not use the assigned dfs for certification (see discussion in the following section, "Calculated dfs for OHV Nonhandheld Engines"). EPA requests comment on the proposed thresholds for limits on the use of the 1.3 assigned df.

EPA recognizes that a requirement to generate an engine-family specific df for certification could be especially burdensome or perhaps practically impossible without disrupting production if the requirement was placed on the manufacturer close to the anticipated start of production for that family. EPA would take such issues into consideration when making any determination to require an engine-family-specific df to be generated.

EPA requests comment on all aspects of today's proposal for assigned dfs and calculated dfs for OHV technology engines, including the proposals for incentives for improving deterioration characteristics of OHV technology engines, and protections against misuse of the assigned dfs. EPA also requests additional data on which to determine the assigned dfs for OHV engines.

Calculated dfs for OHV Nonhandheld Engines

EPA views assigned dfs for OHV technology engines as the program engine manufacturers would most often select due to lower costs for certification. However, it is desirable to allow manufacturers of engines having improved durability characteristics to demonstrate and take credit for these lower dfs. Therefore, EPA is proposing as an option a procedure whereby a manufacturer could generate its own dfs for all engine families within a useful life category, in lieu of applying the assigned df for those families.

The assigned df is based on industry average data with some actual dfs above 1.3 and others below 1.3. EPA anticipates that manufacturers would choose the option of calculating their own dfs, over the option of selecting the 1.3 assigned df, in cases in which their engines exhibit superior deterioration characteristics. EPA is concerned that, if only these engines with superior deterioration characteristics are removed from the evaluation of the industry-wide assigned df values, then the industry average would be influenced upwards.

Therefore, to partially mitigate this concern, EPA is proposing that if a manufacturer chooses to establish its own df for one engine family in a useful life category, then it would be required to do so for all of its engine families within that useful life category. Thus the manufacturer would determine specific dfs for all of its families in that useful life category. In considering the types of data that would be required for manufacturer-determined dfs, EPA balanced the need for the program to be reasonable and practicable, yet rigorous enough to provide confidence in the dfs.

EPA is today proposing that calculated dfs for the full product line of OHV engines in a particular useful life category could be generated by field aging a minimum of three engines per engine family in a representative application to their regulatory useful lives. Each engine would be emission tested at least twice for all regulated pollutants using the full test procedure described in this rule. The first test point would occur after the engine had been stabilized by bench or field aging. The second test point would occur after the engine had been field aged to its useful life. The df for that engine family would be determined based on test data by dividing the average emissions at the full useful life by the average stabilized emissions for that family. If the manufacturer elects to conduct more than one test at either test point then the average of the data would be used. All test data would have to be at or below the standard (FEL, if applicable). EPA is also proposing that calculated dfs may cover families and model years in addition to the one upon which they were generated if the manufacturer submits a justification acceptable to EPA at the time of certification that the affected engine families can be reasonably expected to have similar emission deterioration characteristics.

The Agency is proposing for manufacturers who choose to develop their own OHV dfs by field aging three engines per engine family that these engines must be actual field-aged engines and not bench-aged even if adjusted by a field/bench adjustment factor. The proposed assigned dfs with df verification through the OHV Field Durability Program is the primary program for Class I and II OHV engines. The Agency believes that any alternative to the primary program for nonhandheld OHV engines must generate emission data of similar accuracy as that on which the assigned df and OHV Field Durability Program is based. Without this requirement, the primary program would be undermined. The Agency has proposed a field/bench adjustment program for handheld engines and for non-OHV technology Class I and II engines. In both of those programs the Agency has proposed a level of confidence which would have to be met before a field/bench adjustment factor would be allowed, and is therefore a compromise between data accuracy and test burden (see Section IV.C). The test burden associated with the assigned df and OHV Field Durability Program has been limited to an appropriate level

because it is covered by a maximum number of field aged engines that a manufacturer would be required to test on an annual basis (see Section IV.D.3.c "Maximum Rates for Field Tested Nonhandheld Engines"). However, the proposed OHV Field Durability Demonstration does not permit a compromise on the accuracy of the field test data which would result from a field/bench adjustment program. Therefore, the Agency believes it is not appropriate that an alternative (i.e., manufacturer calculated dfs) to this primary program should allow such a compromise. The Engine Manufacturers Association[45] has recommended to the Agency that manufacturers be allowed to determine their own OHV dfs by performing a field/bench adjustment program. The Agency requests comment on this suggestion.

In the ANPRM, EPA indicated that it would consider during the rulemaking process the appropriateness of reserving certification credits pending verification of the dfs through in-use testing for families for which the manufacturer generates its own df. EPA believes that today's proposal for field aging three engines per engine family for calculating dfs provides adequate data up front to provide assurance as to the deterioration of these engines, and obviates the need to reserve certification credits pending in-use testing. However, engines for which the manufacturer calculates its own df would be subject to the OHV Field Durability Program. EPA requests comment on the proposal not to reserve certification credits pending verification of the dfs through in-use testing.

Finally, to provide flexibility during the phase-in of the 12.1 g/kW-hr Class II standard, EPA is proposing that manufacturers choosing to establish their own dfs for the 500 and 1000 hour useful life categories for Class II OHV engine families may, with the advance approval of the Administrator, base their dfs on good engineering judgement (subject to future verification, as discussed below in Section IV.E).

b. Handheld Certification

This notice proposes that the certification of handheld engines continue as in Phase 1, except that manufacturers would be required to generate and apply a df to their stabilized emission results. EPA is proposing that manufacturers would be allowed to establish a df for each engine family based on technically appropriate analysis of test data on that engine family (or engine families of sufficiently similar design to be expected to have the same emissions durability) to reflect the emission deterioration expected to occur over the useful life of the engine. Manufacturers would be required to retain test data and description of their analysis to support their choice of dfs and to furnish this information to EPA upon request. EPA may reject the manufacturer's choice of df if it has evidence that the actual df is significantly higher or if the test data and analysis do not support the manufacturer's determination of a df. Data in support of the df could include data from the field/bench adjustment factor program as well as data from the in-use

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[45]See Memo to the Docket regarding the October 3, 1997 meeting between U.S. EPA and the Engine Manufacturers Association, EPA Air Docket A-96-55, Item #II-E-11.

testing program.

EPA believes that the proposal to allow manufacturers flexibility in determining the test data necessary to establish dfs for handheld engine families is a reasonable program designed to assure the environmental benefits of the program are met without placing an undue burden on manufacturers at the time of certification. EPA requests comment on all aspects of the proposed provisions for certification of handheld engines and determination of emission deterioration factors for compliance purposes.

c. Certification to CO Emissions Standards

EPA is proposing that provisions for establishing CO emission dfs for use in the certification and production line testing programs would be the same as the provisions for established HC+NOx (or NMHC+NOx) emission dfs, except in the case of OHV technology engines for which the manufacturer elected to use an assigned df. For these engines, the manufacturer would be allowed to establish a df for CO emissions using good engineering judgment.

d. Streamlining of the Certification Process

Since the promulgation of the Phase 1 rule, EPA has taken great strides to reduce the volume of information that must be submitted to obtain certification. A direct final rule published on May 8, 1996 (61 FR 20738), greatly reduced the reporting requirements necessary to obtain certification under the Phase 1 program. This proposal would continue the reduced reporting requirements, adding only information items related to new provisions required for the Phase 2 program.

EPA has also made strides to facilitate the electronic submittal of certification materials. Certification applications can currently be submitted on a computer disk, and the Agency hopes soon to be able to receive applications through a telephone data link. Further, EPA is working with the California Air Resources Board (CARB) in an effort to develop a common application format that would reduce the certification burden for manufacturers. EPA anticipates that for the Phase 2 program, EPA and CARB would accept the same application format and would have the same application submittal process.

2. Production Line Testing

This section addresses the production line testing program proposed today for nonhandheld and handheld engines. EPA is proposing that manufacturers conduct a manufacturer-run production line testing (PLT) program using the Cumulative Sum (CumSum) procedure, as the primary program for ensuring the emission performance of

production engines.[46] The Phase 1 rule relies upon a traditional Selective Enforcement Auditing (SEA) program for production line compliance. SEA is a statistical sampling and testing scheme that must be initiated by EPA and provides a snapshot indication of whether a given engine family complies with applicable standards or FELs at a given point in time.

In the proposed Phase 2 PLT program, manufacturers would conduct continuous production line testing of all engine families and feed the results of that testing back into their design and production processes. CumSum is a statistical sampling and testing procedure which results in random periodic sampling and testing of engines from each engine family. The proposed CumSum procedure is useful both as an assessment tool for EPA and a quality control tool for engine manufacturers. The CumSum procedure assures that all configurations are susceptible to testing proportional to their production, and provides for continuous testing throughout the model year (except in cases in which an engine family shows clear compliance with the standards, in which cases testing can halt early, in as few as two engines). The CumSum procedure also allows manufacturers to monitor their own production and to fit production line testing into their normal production quality control procedures. The procedure is capable of detecting significant changes in the average level of a process, while ignoring minor fluctuations that are simply acceptable variation in the process. In summary, EPA believes that the CumSum procedure provides an effective measure for meeting EPA's goal of assuring that production engines comply with the applicable standards or FEL before they leave the production facility.

As testing of each engine family begins with a new model year, the CumSum process computes an action limit and a test statistic based on the deteriorated test results for each pollutant for each family. As new data are received, both the action limit and the test statistic are updated. The action limit and the test statistic are functions of the standard deviation of the sample. If the test results are clearly below the standard or FEL, and the standard deviation of the test result is appropriately low, the process will declare a halt to testing. With very low emitting engines, this can occur in as few as two tests. If test data are highly variable or the test results are very close to the standard or FEL, testing may proceed to as many as thirty tests per family (the proposed maximum test limit) spread equally throughout the model year. If the test statistic crosses the action limit for two sequential tests, then the process indicates a nonconformity and the manufacturer would be required to take corrective measures.

EPA is proposing a manufacturer-run PLT program for both nonhandheld and handheld engines. However, for nonhandheld engines, while PLT is the preferred option,

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[46]The CumSum procedure has been promulgated for marine engines in EPA's spark-ignition marine rule at 40 CFR Part 91 (61 FR 52088, October 4, 1996). In this section, "PLT" refers to the manufacturer-run CumSum procedure, or other manufacturer-run production line testing procedure approved by EPA. "PLT" does not include Selective Enforcement Auditing (SEA), which is addressed separately in Section IV.D.2.d.

EPA also is proposing an alternative program under which manufacturers would have the option to elect to be subject to the traditional SEA program (rather than PLT), as described in Section IV.D.2.d, below. In addition, EPA is proposing to retain SEA for "backstop" purposes when manufacturer-run PLT is being conducted for nonhandheld and handheld engines, as described below. Under the proposal, in some cases, some manufacturers or engine families may have the option not to conduct production line testing requirements, including manufacturers of very clean engine families, or manufacturers or families which qualify for small volume flexibilities, as described in Section IV.E. The following discussions outline the proposed CumSum procedure, reporting of PLT results, procedures in the event of PLT failures, the use of SEA, and other topics related to production line compliance testing.

a. The CumSum Procedure

The proposed CumSum procedure is outlined in this section. At the start of each model year, manufacturers would begin to test each newly-certified engine family at a rate of one percent of production. After conducting two tests, a manufacturer would determine the required sample size for the rest of the model year according to the sample size equation.[47] For carry-over engine families, to reduce testing burden, the manufacturer would determine the necessary sample size by conducting one test, then combining the test result with the last test result from the previous model year, and finally calculating the required sample size for the rest of the model year according the sample size equation. Tests would be required to be distributed evenly throughout the remainder of the model year. After each new test, the sample size would be recalculated with the updated sample mean, sample standard deviation, and 95 percent confidence coefficient.

The manufacturer would be allowed to stop testing at any time throughout the model year if the sample mean for each pollutant is less than or equal to the applicable standard or FEL, and if the number of tests required of the manufacturer, as calculated by the sample size equation, is less than the number of tests conducted. However, if at any time throughout the model year the sample mean for any pollutant is greater than the applicable standard or FEL, and if the manufacturer has not reached a "fail" decision, the manufacturer would be required to continue testing that engine family at the appropriate sampling rate.

The maximum required sample rate for an engine family, regardless of the result of the sample size equation, would be the lesser of three tests per month to a maximum of 30 per year, or one percent of projected annual production, distributed evenly throughout the model year. For example, if the sample size equation produces a value of 252 tests for a family with annual production of 20,000 engines, a manufacturer could elect to test only three engines per month to a maximum of 30 per year, instead of either 21 per

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[47]For more discussion of the sample size equation, see Proposed Procedure for Quality Audits of Marine and Small Engines: A Cumulative Sum Approach, Item #IV-B-03 in EPA Air Docket A-92-28.

month (which would be required if 252 tests were distributed evenly throughout the model year), or 17 per month (which would be required if one percent of annual production were distributed evenly throughout the model year).

Although the sample size equation may calculate sample sizes greater than the proposed maximum sample rates, EPA believes that above some sample size, the cost of testing would become unnecessarily burdensome for manufacturers of small SI engines. Further, EPA believes that the proposed maximum sample rates (e.g., 30 engines) are sufficiently large to adequately characterize the emission levels of the engine family for the purpose of making a compliance decision. After determining the appropriate sample size, the manufacturer would construct a CumSum equation for each regulated pollutant for each engine family. Following each emission test, manufacturers would update current CumSum statistics for each pollutant according to the CumSum equation. Manufacturers would continue to update the CumSum statistics throughout the model year.[48]

Manufacturers could elect to test additional engines provided that testing of the additional engines is performed in accordance with the applicable federal testing procedures for small SI engines. Such testing could be used, for example, to bracket a nonconformity determined through the CumSum procedure, and such bracketing could be used to reduce a manufacturer's liability for past production. If a manufacturer elects to perform additional testing, the results would not be included in the CumSum equation. However, the results of additional tests would be included in the quarterly reports to EPA. Manufacturers would be required to randomly select which engines are to be included in the CumSum program prior to any knowledge of the emission levels of CumSum engines or engines used for additional testing.

In cases where the CumSum sample size equation indicates that testing can be halted, the CumSum process indicates that there is 95 percent probability for each pollutant that the mean emission level for the engine family is below the applicable standard (or FEL). In cases where the test statistic exceeds the action limit for two consecutive tests, then EPA is highly confident, based on extensive computer simulations of the CumSum program, that the mean emission level of the engine family for that pollutant exceeds the standard (or FEL), i.e. that the engine family is in noncompliance for that pollutant. The risk that a complying engine family will incorrectly be determined to be noncomplying (manufacturer risk) is set at similar levels as in EPA's historical SEA program. The risk that a noncomplying engine family will incorrectly be determined to be in compliance (consumer risk) is set at improved (lower) levels as in EPA's SEA program. The Agency requests comment on all aspects of the proposed production line testing program and CumSum procedure. For more information on the derivation of the sample size and CumSum equations and some examples of the CumSum procedure, see the document "Proposed Procedure for Quality Audits of Marine and Small Engines: A

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[48]For more discussion of maximum sample rates and updating CumSum statistics, see Proposed Procedure for Quality Audits of Marine and Small Engines: A Cumulative Sum Approach, Item # IV-B-03, in EPA Air Docket A-92-28.

Cumulative Sum Approach" (EPA Air Docket A-92-28, Item # IV-B-03).

b. Reporting of CumSum Results

EPA proposes that production line emission test results, as well as sample size calculations and CumSum calculations, would be reported to EPA on a quarterly basis. The Agency would then review the test data, sample size and CumSum calculations to assess the validity and representativeness of each manufacturer's production line testing program. If the CumSum process determines that an engine family is in noncompliance, the manufacturer would be required to report the emission test results and the appropriate sample size and CumSum equation calculations within two working days of the occurrence of the noncompliance.

EPA received comments on the ANPRM recommending that, in the event of a PLT failure, manufacturers should be required to report such exceedances within thirty days of discovering the failure, suggesting that thirty days provides a reasonable time for manufacturers to evaluate and verify test data and determine the existence of any production line problems. EPA believes that thirty days is too long a period for the Agency to not be made aware of a PLT failure. Such delays would not occur, for example, under a traditional SEA program. In the event of a traditional SEA, EPA is aware immediately of the existence of an SEA failure, and can immediately begin working with the manufacturer to remedy the problem. EPA is proposing that the appropriate PLT test results be reported within a two working days, a time period consistent with that promulgated for the gasoline marine PLT program. A two-day delay in reporting would not unnecessarily delay EPA's ability to begin to work with manufacturers during that time to determine an appropriate response to a PLT failure. As discussed below, the manufacturer would have 30 days after the date of the last test before any suspension or revocation of a certificate for the engine family would occur. The manufacturer could use that time to determine the existence of production line problems.

EPA also received a comment that manufacturers should not be required to report all resultant test data to EPA quarterly (e.g., extensive raw test data in addition to calculated emissions results). This commenter suggests that the submission of a completed CumSum summary data sheet, permitting EPA to confirm that an engine family is in PLT compliance and to see where in the CumSum process compliance was attained, should be sufficient for quarterly reporting, and that manufacturers could maintain raw PLT data for a reasonable period of time and make such data available to EPA upon request.

It is not clear which raw data this commenter would prefer be allowed to be retained at the manufacturer's facility. EPA is proposing that manufacturers would submit to EPA on a quarterly basis pertinent engine information, individual test results, relevant CumSum calculations, and other information at Section 90.709(e) of the proposed regulations. EPA does not believe that this reporting requirement is overly burdensome. EPA expects that manufacturers will keep track of PLT data electronically, and EPA intends to develop a standard CumSum summary data sheet to facilitate

electronic submittal of data for the quarterly reports. EPA requests comments on these proposed provisions.

c. Production Line Testing Failures

If an engine family is determined to be in noncompliance, or a manufacturer's submittal to EPA reveals that production line tests were not performed in accordance with applicable federal testing procedures, under the proposal EPA could suspend or revoke the manufacturer's certificate of conformity in whole or in part for that engine family subject to a thirty day waiting period (discussed in more detail below in Section IV.D.2.c.iv). EPA could reinstate a certificate of conformity subsequent to a suspension, or reissue one subsequent to a revocation, after the manufacturer demonstrates that improvements or modifications have brought the engine family into compliance. The proposed regulations include provisions for a hearing in which a manufacturer may challenge EPA's decision to suspend or revoke a certificate of conformity based on the CumSum procedure.

EPA is proposing procedures whereby a manufacturer could remedy the emissions problems from engines produced prior to the PLT failure. In EPA's traditional SEA program, SEA failures have typically been addressed by a recall of the past production engines for the failing family. Future production engines are expected to be brought into compliance by either adjustments to the certification FEL, in cases where the manufacturer is participating in a certification ABT program, or through appropriate engine and emission control system modifications. As discussed in Section III of this preamble, above, EPA is proposing alternative remedies in the event of PLT failures, given the likely difficulties of applying a traditional recall program to the small SI engine industry. For handheld engines, these procedures include the use of in-use credits or other alternative remedies. For nonhandheld engines, these procedures include the use of certification credits through the adjustment of a family's FEL or other alternative remedies. These procedures are discussed below.

i. Handheld engines

EPA is proposing that when handheld manufacturers experience PLT failures, the excess emissions from engines that have already been introduced into commerce could be addressed by the application of in-use credits or another alternative remedy. In-use credits are discussed in detail in Section IV.D.3, below. The emission performance of future production would be addressed through a running change to the existing configuration or certification of a new configuration such that compliance is demonstrated.

ii. Nonhandheld engines

Unlike the proposed program for handheld engines, the program proposed today for nonhandheld engines does not include provisions for in-use credit generation. Since

in-use credits would not be available, and since recall of small SI engines is not likely to be effective, for nonhandheld engine manufacturers who use averaging, banking and trading to obtain certification, this notice proposes that, in the event of a CumSum failure, the manufacturer would be permitted to adjust its certification FEL to a level for which compliance could be demonstrated. This adjustment would apply to both past and future production of that family.

EPA has held in past programs that manufacturers should be liable for their FELs, and that the past production of that family is subject to recall if the family exceeds its FEL during an SEA. The Agency continues to believe that manufacturers should set FELs appropriately based upon adequate testing and engineering analysis. Thus, while proposing that nonhandheld engine manufacturers would be permitted to adjust FELs for past production of an engine family, EPA expects that the need for manufacturers to change an engine family's FEL retroactively in the event of CumSum failures should be rare or nonexistent. If there are substantial occurrences of the need to adjust FELs retroactively, this would suggest that manufacturers are not correctly setting FELs carefully and accurately for individual families, in which case the Agency should appropriately revisit this provision.

EPA is also proposing that nonhandheld manufacturers who experience CumSum failures could adjust their FELs even if they did not have adequate credits, provided that they could obtain the necessary credits by the end of the model year following the model year in which the production line failure occurs. If sufficient credits were still not obtained, the manufacturer would have two more years to obtain them, but would then be required to use credits on a 1.2 to 1 basis (i.e., such credits would be discounted twenty percent). Unlike in the proposed handheld engine in-use credit program, in which manufacturers would have opportunities to generate additional credits, the nonhandheld certification ABT program would not afford such opportunities. Thus, EPA believes it is reasonable in the program for nonhandheld small SI engines to provide additional time for manufacturers to acquire certification credits necessary to offset PLT exceedances. Requiring future model year credits to be discounted if used to remedy past production on noncompliance assures that the manufacturer will not benefit economically from delayed compliance with the standards.

Because EPA believes manufacturers should set FELs accurately and carefully, and to encourage manufacturers to set FELs accurately, EPA is proposing that these provisions (e.g., the retroactive use of credits, and the ability to carry a credit "deficit") would only apply in the case of a manufacturer who fails no more than one engine family in a given model year, or who fails more than one engine family but the total production of those families is no greater than 10 percent of the manufacturer's U.S. sales. EPA requests comment on all aspects of this retroactive use of certification credits and its likely impact on the accuracy of the FELs determined at certification.

iii. Alternative Programs and Voluntary Recall

In the event of PLT failures, EPA prefers that handheld manufacturers use in-use credits for past production engines and that nonhandheld engines be recertified to a

higher FEL which may require the application of certification credits, rather than some other alternative to recall. However, EPA is proposing that in the case of handheld or nonhandheld engines where the manufacturer did not have and could not obtain adequate in-use or certification credits, as appropriate, a manufacturer could conduct a voluntary recall, if it could show that an appropriate response rate was likely. EPA would also consider the appropriateness of alternative projects. These projects are essentially alternatives to recall and would be designed to provide an environmental benefit as well as an economic incentive to the manufacturer to produce complying engines. Guidelines for such projects are discussed in more detail in Section IV.D.4, below. A mandatory recall could be ordered by EPA for past production engines pursuant to proposed §90.808 in cases where the manufacturer could not obtain appropriate credits and was unwilling to perform an alternative project acceptable to EPA.

iv. Suspensions and Revocations

EPA is proposing for engine families that fail production line compliance testing, that EPA would have the authority to suspend or revoke the certificate for that family. However, no suspension or revocation for a family could occur before thirty days after the date of the last test. During the thirty day period, EPA intends to work diligently with the manufacturer, as it always has in the case of SEA failures, to provide certification of appropriate production line changes. Further, this notice proposes that EPA would approve or disapprove a manufacturer's production line change within fifteen days of receipt, or the change would be considered automatically approved.

EPA believes that these waiting periods are reasonable to afford manufacturers and EPA sufficient time to work together to address problems, without the concern that EPA would hastily suspend or revoke the certificate of a family determined to be in nonconformity by a production line testing program. EPA believes that the proposed time frames are reasonable, and are consistent with longstanding EPA practices in the SEA program of providing a waiting period following an audit failure. In such failures, EPA works closely with the manufacturer to arrive at a solution for the problem engine family. With on-highway engines, such solutions have typically involved a recall of engines that have already been produced along with the recertification of the family to a new FEL, or the certification of a replacement engine configuration. As discussed above, for small SI engines, such solutions could involve the use of certification or in-use credits, voluntary recalls, or other alternative remedies. EPA has never caused an assembly line to shut down because of an audit failure and does not intend to start such a practice where other alternatives can be used.

d. Selective Enforcement Audits (SEA)

While EPA is proposing the CumSum manufacturer-run PLT program as the preferred production line testing program for the Phase 2 program, EPA still sees a function for traditional SEA and is therefore not proposing to eliminate traditional SEA altogether. EPA is proposing that for both nonhandheld and handheld manufacturers,

SEA would remain as a "backstop" for EPA to use in cases where there is evidence of improper testing procedures or nonconformities not being addressed by the CumSum process.

As mentioned earlier, the Agency is also proposing an alternative program under which nonhandheld manufacturers could choose not to conduct manufacturer-run PLT program, in which case all families would continue to be subject to an SEA program as under Phase 1. Although currently not preferred by the Agency, EPA is considering this option since it was included in the ANPRM and received support from the nonhandheld industry. EPA solicits comment on the appropriateness of providing this option, and on whether it would be better to require PLT for all families. Only one approach, either PLT with SEA as a "backstop", or manufacturers having the choice to use either PLT or SEA as the primary program, will be adopted as the final rule for nonhandheld manufacturers.

Under this alternative program, EPA is also proposing that nonhandheld engine manufacturers be limited in their ability to switch back and forth between PLT and SEA. Manufacturers involved in PLT would be required to implement that approach for a minimum of three consecutive model years and to provide EPA with notice one complete model year prior to the model year for which they were planning to opt out. In addition, a manufacturer would not be allowed to opt out of PLT while carrying a negative certification credit balance. However, a manufacturer would be allowed to opt in to PLT at any time.

Finally, where small volume engine manufacturers or small volume engine families would be entitled to exemptions from the PLT program under the proposal (see Section IV.E), those families would remain subject to SEA, although EPA would be unlikely to issue test orders without evidence of nonconformity.

In the event of an SEA failure for handheld engine manufacturers, EPA is proposing that the option to use in-use credits or another alternative to recall would be available to remedy past production engines. For future production, the manufacturer would be expected to modify the engine to come into compliance with all applicable standards.

In the event of an SEA failure for nonhandheld engine manufacturers, the manufacturer would have the option to adjust the FEL for future production of the engine family. EPA would address a remedy for the past production in the event of an SEA failure on a case-by-base basis, seeking to both preserve the environmental benefits of the program, maintain incentives to accurately set FELs in advance, and minimize the burden on the industry. Such a remedy might include, for example, a combination of measures such as mandatory PLT for appropriate time periods and portions of production, recertification of all or part of an engine family, and generation of credits to remedy exceedances over an appropriate period of time. However, consistent with past practice, EPA does not anticipate allowing the retroactive use of certification credits to remedy past production failures determined via SEA, or the carryover of any credit deficits, as would be allowed if the manufacturer chooses to conduct manufacturer-run PLT. Since SEA only evaluates production line performance during a "snap shot" in time and not throughout the entire production period, it would be inappropriate to use credits generated on the basis of total annual production to correct the SEA failure. Instead, a

manufacturer would likely be expected to recall the noncomplying family or conduct an alternative remedy proposed by the manufacturer and accepted by EPA. EPA requests comments on the proposed provisions related to remedies for SEA failures.

EPA received a comment on the ANPRM that handheld manufacturers should be permitted to elect to be subject to routine SEA testing, as they currently are under Phase 1 emissions regulations, rather than conducting manufacturer-run PLT. This commentor suggested that manufacturers may desire to elect SEA for reasons of cost, confidence in their quality control, or familiarity with SEA, and that such an option could enhance the flexibility and reduce the cost of the PLT process, while at the same time assuring new engine compliance with Phase 2 emissions regulations.

EPA is not proposing routine SEA testing for handheld manufacturers. EPA believes that a manufacturer-run PLT program such as CumSum is a superior method of assuring that both handheld and nonhandheld production line engines meet the standards, that testing occurs continuously throughout the model year, and that each configuration is susceptible to testing. In addition, PLT affords benefits to the manufacturers of identifying problems early and addressing them without the disruption of an EPA-initiated SEA. EPA believes it is most useful and appropriate that manufacturers be responsible for and bear the burden of continuously monitoring their own emissions.

Under the production line compliance program proposed today, EPA expects that nonhandheld manufacturers may in some cases choose SEA as their primary production line compliance program, for cost reasons or fear of the unknown. However, EPA believes that the downsides of the choice of SEA as the primary production line compliance program are potentially great for all involved. EPA believes that in choosing SEA, the manufacturers would be foregoing an effective quality control tool for monitoring their own production, and would risk expensive and disruptive SEAs. In addition, EPA would not get the same coverage of engine families in the testing process. The regulations proposed today reflect the option, consistent with the program outlined in the ANPRM, for nonhandheld manufacturers in some cases to choose either PLT or SEA as the primary production line compliance program. However, EPA is also proposing in the alternative that the nonhandheld production line compliance program would be the same as the handheld program. That is, the manufacturer would not have the option to choose SEA as the primary production line compliance method. Rather, manufacturer-run PLT would be the primary program in all cases, with SEA existing as a backstop. Again, EPA requests comment on the appropriateness of the proposed program which allows nonhandheld manufacturers the option to elect routine SEA testing in lieu of PLT testing. EPA also requests comment on the option that nonhandheld manufacturers would use only PLT as the primary production line compliance program, with SEA existing as a backstop, and the effectiveness of this option in providing assurance of environmental benefits in-use, easing the implementation burden for EPA and the industry, and achieving greater commonality in the compliance programs for the handheld and nonhandheld sides of the small SI engine industry.

e. Annual Limits for SEA

The Phase 1 program contains annual limits on the number of SEAs the Agency may perform each year on a manufacturer, based on their number of engine families and sales. The Phase 1 annual limits serve to restrict the maximum number of audits for most manufacturers to a quantity equal to one fifth of the number of engine families (see 40 CFR 90.503(f)(1)). However, under the Phase 1 program, any test which the family fails or for which testing is not completed does not count against the annual limit (see 40 CFR 90.503(f)(3)). In addition, even if the annual limit is reached, EPA may initiate additional SEA testing to test families for which evidence exists indicating noncompliance (see 40 CFR 90.503(f)(4)).

EPA is not proposing any changes to the Phase 1 SEA annual limit provisions for Phase 2 except for the additional proposed provision that EPA may initiate additional SEA testing beyond the annual limit for families or configurations which the Administrator has reason to believe are not being appropriately represented or tested in production line testing (see proposed §90.503(f)(4)).

EPA also requests comment on an option, not proposed, to raise the annual limit by one or two families for each failing audit in a given model year in cases where manufacturers choose SEA as the primary production line compliance program, should the regulations allow SEA as the primary production line compliance program. While this option is not included in the proposed regulatory text, EPA requests comment on the potential benefits or costs of this option for a higher number of potential routine SEAs for manufacturers who experience SEA failures. EPA requests comment on all aspects of the proposal for annual limits for SEAs under the proposed Phase 2 program.

f. Alternate Statistical Procedures for Production Line Testing

Consistent with the program outlined in the March 1997 ANPRM, EPA is proposing that manufacturers conducting manufacturer-run PLT could propose test schemes for EPA approval on a case-by-case basis other than the CumSum procedures described in this section and proposed in today's notice. EPA believes that this is reasonable because there may be situations where a single test scheme is not appropriate for a specific engine family or company. However, EPA also believes that it is desirable to avoid a multiplicity of testing schemes, and is concerned about the burden this could place on the Agency if multiple testing schemes are analyzed and developed with individual manufacturers. This notice proposes that EPA would have the right to review any alternate procedure to determine the ability of the procedure to 1) produce substantially the same levels of "producer risk" and "consumer risk" as the CumSum Procedure, i.e., the risk to a manufacturer that a complying family would fail in PLT testing, or the risk to the public that a failing family would pass in PLT testing; 2) to provide for continuous rather than point-in-time sampling; and 3) to include an appropriate decision mechanism for determining noncompliance upon which the Administrator can suspend or revoke the certificate of conformity. Further, it would be the requesting manufacturer's responsibility to provide an analysis and documentation that demonstrated the alternative satisfied these criteria. EPA would expect to reject any alternate statical procedure that did not fully satisfy these proposed criteria.

g. Test Procedures for PLT

EPA believes that the best way to determine whether new engines meet certification standards is to test them under the test used at certification. Therefore, EPA is proposing that the manufacturer-run PLT program proposed in this notice would require testing based on the full federal test procedure as used for certification and described in Subpart E of the attached regulations. EPA recognizes the potential need to permit minor adjustments to the test procedure to accommodate production line testing. Consistent with other compliance test programs for mobile sources, the proposed regulations allow the Administrator to approve such test procedure adjustments.

h. Harmonization of Production Line Testing with CARB

EPA is interested in finding ways to harmonize the production line testing requirements proposed today for Phase 2 with any production line testing requirements manufacturers must meet for the California small engine regulatory program. In particular, EPA would expect that data from production line testing of a 50-state family conducted for a California Quality Audit program could be acceptable for the CumSum process, if the subject engines are sold nationwide and test engines are appropriately selected and tested. EPA will also continue to work with the California Air Resources Board to harmonize reporting formats, and similar information needs.

3. In-use Emission Testing

EPA believes that a critical element in the success of its small SI engine program is ensuring that manufacturers build engines that continue to meet emission standards beyond certification and production stages and comply with standards for their full regulatory useful lives. Section 213(d) of the CAA specifically subjects nonroad engines to the in-use compliance provision of section 207.[49] EPA has authority to subject manufacturers to in-use testing (conducted by the Agency or by the manufacturer under section 208 of the Act) and to remedy any noncompliance (for example, by recall and repair of engines) for the full regulatory useful life of an engine. In-use compliance enforcement has proven to be an effective incentive for manufacturers to build emission durable motor vehicles.

However, as discussed above in Section III, in the case of small SI engines, EPA does not believe that a mandatory in-use compliance program which relies on recall, for example, is likely to be as effective and practical as it has proven to be in EPA's on-

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[49]Section 207(c) of the Act authorizes EPA to enforce compliance by vehicles and engines to applicable standards in actual use. Manufacturers are subject to recall "[i]f the Administrator determines that a substantial number of any class or category of vehicles or engines, although properly maintained and used, do not conform to the regulations...when in actual use...".

highway programs. Small SI engines differ from motor vehicles in that they are not registered and are therefore difficult to track so that their owners can be notified. Many are not easily transported to a servicing dealer for repair. The in-use programs described below are therefore designed to provide data on in-use performance and to provide incentives to manufacturers to produce emission-durable engines without relying on the use of recall. While the Production Line Testing programs described previously are very similar, the in-use programs proposed in this notice differ significantly for the two sides of the industry. Again, EPA requests comment on alternative in-use testing programs, such as applying the in-use testing program proposed for handheld engines to the nonhandheld side of the industry, as well as applying the field durability program proposed for OHV engines to side-valve engines, engines with aftertreatment, and/or handheld engines.

a. Nonhandheld Side-Valve Engines and Engines with Aftertreatment

For nonhandheld side-valve engines and engines with aftertreatment, the in-use program would consist of a certification program in which the engines would be aged to their full useful lives during the certification process and no certificates would be issued unless the engine family can first be shown to meet standards (or FELs) for its useful life, as described above in Section IV.C and Section IV.D.1. EPA believes that a program which does not rely on in-use testing after certification especially makes sense for Class II SV technology engines which are expected to be phased out by 2005. In addition, EPA would have data on SV technologies aged in the field for the field/bench adjustment factor program; if EPA suspected serious problems with regard to whether the emissions reductions anticipated by this rule were in fact being achieved, EPA would address these concerns through appropriate programmatic changes. EPA requests comment on the appropriateness of this full useful life certification to predict the in-use emissions durability of SV engines and engines with aftertreatment.

b. Nonhandheld OHV Field Durability and In-use Performance Demonstration Program

For overhead valve nonhandheld engines, the proposed in-use program would be one whose primary function is to verify that the industry-wide deterioration factors predicted for the OHV engines are indeed correct. The proposed OHV field durability and in-use performance demonstration program ("Field Durability Program") would generate significant quantities of emission data from engines aged in real field usage in representative pieces of equipment. If EPA's belief that the dfs of these engines are stable and predictable proves to be incorrect after receiving these data, or the assigned dfs specified in this rulemaking are significantly different than those that occur in real field usage of Phase 2 engines, then EPA would initiate appropriate programmatic changes through the regulatory process.

The proposed Field Durability Program is designed to provide data on the deterioration of OHV engines in actual field usage. EPA is proposing that engines for the program would be selected from or placed into service with residential or professional

users. This program would be designed to provide a representative picture of actual in-use emissions, including representative age, maintenance, and sales mix of engines in the field. To the extent practical, engines would be selected from residential customers or professional users, in order to most accurately reflect actual usage patterns such as number of cold starts, typical maintenance patterns, and overwintering. However, EPA would also allow engines to be selected from manufacturers' fleets, provided the engines and their operation and maintenance are typical of in-use engines. Each engine in the program would be baseline tested at a number of hours equal to the break-in hours used in certification. The engine would then be field aged in an appropriate piece of equipment to full useful life, at which time the engine would be removed and retested. The df would be determined mathematically from the two test points from each engine.

Data from the OHV Field Durability and In-Use Emissions Performance Demonstration Program would not be designed to provide a basis for EPA to make in-use compliance determinations as to whether a particular engine family complies with its standard or FEL at the end of its useful life. Rather, the program is primarily designed to determine whether, in the aggregate, the industry-average assigned dfs for OHV engines are valid. Given the number of manufacturers expected to produce OHV engines and participate in this program, the program would generate meaningful volumes of real in-use data which would yield results indicating whether assigned dfs are realistic.

This notice proposes that the OHV Field Demonstration Program testing could be spread over multiple years. EPA proposes that manufacturers provide a schedule to EPA each year of the engine families and approximate quantities of engines they intend to produce for U.S. sales over the coming four year period, as well as estimates of the number of field aged engines that would be tested each year for the field/bench adjustment program (see Section IV.C) and for calculating dfs for OHV engines at the time of certification (see Section IV.D.1). In addition, manufacturers may wish to recommend a proposed testing plan for the Field Durability Program that, for example, best fits testing into their marketing, production, test facility and budgetary constraints. EPA would consider such information in determining the engine families to be field tested over that time period as part of the OHV Field Durability Program.

Manufacturers have indicated their desire to perform industry-wide OHV Field Durability Program testing to try to reduce the number of engines that must be field aged. EPA is proposing that it would consider requests by manufacturers to work together when it reviews a manufacturer's plan for engine families to be field aged. EPA will review proposals for joint testing to evaluate how thoroughly they cover a portion of overhead valve engine sales, whether they will provide statistically useful quantities of data, and other factors to help EPA ascertain whether OHV dfs from certification are accurate and appropriate.

c. Maximum Rates for Field Tested Nonhandheld Engines

EPA believes that emission data from real field-aged engines would serve a crucial role in validating the use of assigned dfs, calculated dfs, and the aging cycles used for bench-aged certification of side-valve engines. While recognizing the importance of

and need for these data, EPA is also sensitive to the cost and testing burden associated with directing large numbers of engines to be field aged and tested in a given year.

In today's action, EPA is proposing that in any one year the Agency would not require field testing for the OHV Field Durability Program such that, when added to the field testing a manufacturer performs for the optional certification df generation or for the field/bench adjustment program, it would require the manufacturer to emission test more than 24 total engines that were field aged to their full useful life. EPA believes that this number will provide important quantities of data without placing an undue burden on manufacturers. EPA is proposing that it would have the right to require field testing to the maximum amount, and expects that the maximum testing may be required in the initial years of the program. Manufacturers would have the option to field test more engines than required by EPA. EPA anticipates it would reduce the testing burden as appropriate, especially for smaller manufacturers, in subsequent years should, for example, EPA determine that the data being developed is quite stable from year to year.

The discussion of the Field Durability Program in the March 1997 ANPRM indicated EPA would provide "appropriate delays or waivers from the requirement of the bench correlation program in years when a manufacturer also runs the field durability program" (see 62 FR 14754). In the development of this proposal, EPA considered the need to propose procedures to provide for EPA granting delays or waivers from the requirements of the field/bench adjustment program in years when a manufacturer also runs the OHV Field Durability Program. In today's action, EPA is proposing no formal process by which manufacturers would request a waiver from the requirements of the field/bench adjustment program. EPA believes that the need for delays or waivers is obviated by the cap on the number of fully field aged engines EPA would be able to require to be tested in any one year.

The discussion of the Field Durability Program outlined in the March 1997 ANPRM also suggested that EPA would propose an appropriate scaling of the field engine test burden for smaller volume manufacturers (see 62 FR 14754). For this proposal, EPA considered proposing a cap on the number of field tested engines of fewer than 24 engines per year for smaller nonhandheld manufacturers by sales volume. However, EPA believes that a scaling back of the test burden would not be appropriate. Such a scaling would most appropriately be based on the inability of manufacturers to sustain the costs associated with the OHV Field Durability program; however, the ability to sustain the costs of the program would not appear to differ significantly among manufacturers. Therefore, EPA is proposing the same cap on the field engine test burden for all manufacturers. EPA believes that this 24 engine per year cap is a manageable burden on the smaller volume manufacturers as well as the larger volume manufacturers. The Agency does not anticipate identifying families certified by manufacturers who would qualify as small volume engine manufacturers for in-use testing, unless there was evidence of a nonconformity (see discussion in Section IV.E). EPA requests comment on all aspects of the applicability of a cap to the number of field aged engines that EPA could require to be tested in any one year.

d. In-Use Testing Program for Handheld Engines

In today's action, EPA is proposing an in-use testing program for handheld engines similar to that promulgated in the gasoline spark-ignition marine engine rule (see 40 CFR Part 91, Subpart I). As in the marine rule, EPA is also proposing an in-use credit program, as well as a number of criteria for evaluating other alternatives to mandatory recall. Mandatory recall is the primary remedy for noncompliance. However, as in the marine program, EPA is interested in considering options to mandatory recall and, if implemented, will monitor the use of these alternatives to make sure they are as effective as anticipated. EPA believes that the successful implementation of the in-use credits program and the other alternatives would provide a comprehensive remedy to address in-use emission noncompliance, as well as incentives to manufacturers to produce emission-durable engines, without the use of recall. The program for handheld engines proposed today differs from the gasoline marine engine program in that the engines may be bench-aged rather than field-aged, at the manufacturer's option, provided the manufacturer has previously established an adjustment factor between the bench aging cycle and field aging through the program described above at Section IV.C. EPA requests comment on the technical requirements which would allow bench-aged engines to represent the emission performance of field-aged products.

i. In-use testing for handheld engines

EPA is today proposing an in-use testing program for handheld engines which would make all engine families potentially subject to mandatory in-use testing by the manufacturer. The manufacturer would age the test engines in the field to their full useful lives. Alternatively, the manufacturer could choose to age the engines on a bench cycle to their full useful lives, providing that an adjustment factor had previously been established between the bench-aged and field-aged results, through the procedures described above in Section IV.C. The engines would then be emission tested for all regulated pollutants using the full test procedure described in this proposed rule. The number of engines per engine family tested would vary depending on test results. Except for small volume and carry-over engine families, the minimum number of test engines would be four. For each engine that failed any pollutant, the manufacturer would test two additional engines, up to a maximum of ten. Small volume engine manufacturers would begin by testing two engines, adding two more for each failing engine up to the same maximum (see discussion of provisions for small volume engine manufacturers and other flexibilities in Section IV.E). Carry-over engine families would start with one engine. In the end, the emissions for each pollutant would be averaged and the family average compared against the appropriate standard to ascertain compliance. The in-use testing program proposed is designed as a method to provide adequate data on which to make compliance decisions, while allowing the testing of families which are found to emit below standard to conclude as expeditiously as possible.

Manufacturers would provide a schedule to EPA each year of the engine families and approximate quantities of engines they intend to produce for U.S. sale over the coming four year period. EPA would then select engine families to be in-use tested by the manufacturer over that time period or a fraction of that time period. EPA would

identify no more than 25 percent of a manufacturer's families for in-use testing in any one year.

EPA received a comment on the ANPRM that it would be equally effective and potentially less costly to permit engine manufacturers to select the engine families for in-use testing. This would allow manufacturers to schedule in-use testing to better conform to production, marketing and budgetary constraints, and to choose their own mixture of commercial and residential engines to test each year. This commenter added that manufacturers could provide a testing schedule in advance to enable EPA to raise any concerns it has with a manufacturer's test plans.

EPA believes it is important to retain the authority to select engine families for in-use testing that potentially show risk of higher emissions in-use than predicted at the time of certification. Therefore, EPA is proposing to retain the authority select the engine families for in-use testing. However, EPA would work with manufacturers in an attempt to schedule testing to take into account production, marketing, test facility and budgetary constraints and would invite manufacturers to recommend a testing program which best suits their needs.

ii. In-use credit program for handheld engines

As discussed above, the proposed in-use credit program for handheld engines is designed to address in-use nonconformities of handheld engines without the need for ordering manufacturers to conduct recalls of nonconforming engines. A reasonable means must exist to address in-use noncompliance that provides incentives to manufacturers to build emission-durable engines, that can be implemented practically, that encourages additional in-use testing, that offsets additional emissions resulting from noncompliance, and that is not unduly burdensome. EPA believes that the successful implementation of the proposed in-use credit program described below could be part of a comprehensive remedy to address in-use noncompliance, and that EPA would not, in practice, order mandatory recall of Phase 2 engines. When a manufacturer determines its average in-use emission levels for each pollutant, it would compare those numbers against the applicable standards. Emission levels below the standards could generate in-use credits. Emission levels above the standard would require the use of in-use credits. The credit formula as proposed here would be a function of the sales of the engine family, the difference between the family emission average and the applicable standard, the power rating of the engine, load factor, and the useful life of the engine.

In-use credits could be used to remedy emission exceedances of previously produced engines determined to be in nonconformity by in-use testing, production line testing or SEA failures. They would not be useable in handheld certification, and they would not be transferrable to nonhandheld engines, due to the considerable differences between the handheld and nonhandheld programs. Unlike certification credits for nonhandheld engines, they would not be useable for offsetting the high emissions from prospective production of an engine family following a PLT or SEA failure. In such cases, the manufacturer would be required to make a product change to improve emission performance of future production.

EPA is proposing that these in-use credits could be used at any time during the Phase 2 program, and that any future rulemaking concerning Phase 3 standards would address the use of the Phase 2 credits in Phase 3. EPA believes this unlimited life for in-use credits during the Phase 2 handheld program is justified since, if an engine demonstrates that it can remain under standards for its full useful life, then an environmental benefit has occurred and the manufacturer is entitled to that benefit for later use. However, unlimited life is not being extended beyond the Phase 2 program at this point, given the concern that Phase 2 credits could be used to effectively delay the implementation date of any Phase 3 standards. EPA requests comments on all aspects of credit life for in-use credits in the handheld in-use credits program.

A manufacturer could use in-use credits to average against in-use failures identified in that model year's testing. It could bank the credits for use in a later model year or trade the credits to another manufacturer. Manufacturers could test additional families and would generate or require additional credits according to that testing. However, the manufacturer would be required to report all in-use testing to EPA, including any test engines that were deleted from the aging process or testing process, and to provide to EPA a technical justification to support the deletion.

No restrictions are proposed on the application of in-use credits from one handheld engine class to another. EPA is not aware of any environmental or competitive concerns with allowing unrestricted use of in-use credits across handheld engine classes. EPA requests comments on the need for cross-class averaging restrictions, and the impact of having or not having them.

EPA is also proposing an adjustment factor to increase credits earned as the in-use testing sample size increases, similar to the program promulgated for the gasoline marine engine rule (see 40 CFR 91.1307). The proposal for an adjustment factor is reasonable because EPA's statistical certainty of the sample mean generally will increase with sample size.

In addition, EPA is proposing a provision that would require manufacturers to apply in-use test results to two past and one future model year when the engine family being tested meets the carryover criteria for those model years. EPA contemplates that manufacturers would not make frequent significant changes to engine families and that carryover certification would be common. Essentially, under this provision, the test results from one model year could apply to up to four model years; the one subject to testing, the two previous model years and the next model year. In-use credits would be generated or required, as appropriate. EPA requests comment on the appropriateness of and the need for these provisions.

The handheld in-use credit program is meant, in part, to obviate the need to resort to a traditional recall program, and the Agency wants to ensure that this alternative program, or any other alternatives considered, provide incentives to manufacturers to design engine configurations that will comply with standards for their entire useful lives. EPA believes that manufacturers should make every effort to prove out their designs prior to certification so that in-use nonconformities will not occur. Therefore, this notice proposes that credits be discounted by 10 percent before they are used. This would

require a manufacturer to obtain or generate credits sufficient to offset 110 percent of the emissions from a family found to be in noncompliance. This discount is consistent with that applied to in-use credits in the gasoline marine rule. Comment is requested on the appropriateness of such discounting and on the appropriate size of the discount.

4. Criteria for Evaluating Alternatives to Mandatory Recall

This proposal contemplates that for handheld engines, in-use credits would be the primary method of addressing emission nonconformities determined through in-use testing or production line testing, whether through the use of credits banked or averaged, or credits purchased through available sources. For nonhandheld engines, EPA is proposing that in some cases, the use of certification credits would be allowed as a method of addressing emission exceedances determined through production line testing (as discussed above in Section IV.D.2).

However, EPA is also proposing that manufacturers have available alternatives to using in-use credits or certification credits, if they lack sufficient credits and are unable to obtain them, that would still avoid necessitating an order for mandatory recall. One such alternative could be for the manufacturer to conduct a voluntary recall. However, EPA would consider other alternatives as well. This proposal contains a number of criteria for evaluating alternatives to determine whether they meet the goals of addressing the environmental impact of the in-use problem while providing incentives to the manufacturer to produce emission-durable engines. EPA intends to allow a manufacturer to implement a reasonable alternative that met these criteria prior to making a determination of substantial nonconformity under section 207 of the Act.

In evaluating alternatives to mandatory recall, EPA would consider alternatives which (1) represent a new initiative that the manufacturer was not otherwise planning to perform at that time and that has a nexus to the emission problem demonstrated by the subject engine family; (2) cost substantially more than foregone compliance costs and consider the time value of the foregone compliance costs and the foregone environmental benefit of the subject family; (3) offset at least 100 percent of the exceedance of the standard; and (4) are able to be implemented effectively and expeditiously and completed in a reasonable time.

These proposed criteria would function as ground rules for evaluating projects to determine whether their nature and burden is appropriate to remedy the environmental impact of the nonconformity while providing assurance to the manufacturer that EPA would not require excessive projects.

In addition to being evaluated according to the above criteria, EPA is proposing that alternatives would be subject to a cost cap, as contemplated by the proposal for handheld engines in the March 1997 ANPRM. EPA proposes a cost cap of 75 percent above and beyond the foregone costs adjusted to present value, provided the manufacturer can appropriately itemize and justify these costs. EPA believes that this is an appropriate value which is both “substantial” and sufficient to encourage manufacturers to produce emission durable engines and maintain positive in-use credit balances.

In deciding what cost cap to propose, EPA believes a figure of 75 percent more than the foregone costs adjusted to present value is consistent with and informed by the principles inherent in the criteria for evaluating alternatives to recall. For example, criterion (2) would require that the alternative must cost substantially more than the costs the manufacturer was able to forego by producing a nondurable engine, and consider the time value of those foregone costs.

EPA believes that manufacturers should prove out the in-use durability of their designs carefully before certification and desires to set the cost cap for alternative projects high enough that manufacturers will take measures to carefully evaluate in-use durability before certification and to bank and maintain substantial in-use credits to handle an unforeseen problem. EPA believes that a cost cap which would merely measure the foregone costs, and adjust them to their present value would not provide the appropriate incentive, because the manufacturer would "break even" and may become indifferent between assuring in-use durability up front and addressing it only when durability problems are detected.

EPA is proposing in this rule that in-use credits be discounted by 10 percent when they are used. If in-use credits are marketed freely and their price is determined by what it costs to generate them, a manufacturer would pay at least 10 percent more than it cost another manufacturer to comply with the standards and generate the credits. This suggests that the minimum figure for the cap should be at least 10 percent of the failing manufacturer's foregone costs, after those costs have been adjusted to the present value. Given that under the proposal no more than one fourth of a manufacturer's families would be subject to in-use testing in a given year, a manufacturer that produces a non-durable, non-carryover family has at most a 25 percent chance that EPA would be aware that such a non-durable family was being produced. A reasonable individual might risk a 10 percent cost penalty if the risk of actually having to pay it was never more than 25 percent. EPA can not estimate the savings a manufacturer may reap by building a non-durable engine, and therefore can not compute the expected value of the savings when the 25 percent risk factor is added in.

EPA believes a figure of 75 percent more than the foregone costs adjusted to present value would be both "substantial" and sufficient to encourage manufacturers to produce emission durable engines and maintain positive in-use credit balances. EPA notes that these projects are alternatives to recall and that a recall with a response rate similar to those in the motor vehicle program would likely have a much higher cost than would be permitted under a 75 percent cap. EPA considered proposing that the cap be tied to the cost of purchasing in-use credits on the open market, but is concerned that these alternatives would be needed when there are no in-use credits available for sale. Further, based on EPA experience with other ABT programs, there is no guarantee that routine sales of credits would ever occur. EPA requests comment on the appropriate cap and the appropriate methodology for determining the cap, and the difficulties that could be faced in trying to ascertain foregone costs.

E. Flexibilities

This section addresses a variety of flexibilities proposed today to ease the transition from the Phase 1 to the Phase 2 program, to ensure that the Phase 2 standards are cost-efficient and achievable, and to reduce the compliance burden while maintaining the environmental benefits of the rule. Following an overview of the approach to providing compliance flexibilities, and a discussion of the proposed cutoffs for determining whether a manufacturer, an engine family, or an equipment model would qualify for the flexibilities proposed today, this section describes the flexibility provisions proposed today, including general flexibilities, phase-in flexibilities, flexibilities to address the concerns of small volume engine manufacturers, flexibilities to address the concerns of small volume equipment manufacturers, and provisions to encourage engine availability. While some of these flexibilities may overlap, EPA is proposing these flexibilities as a means to reduce the compliance costs of the proposed rule for those that can least afford them, while maintaining the environmental benefits of the proposed rule and adopting the most stringent emissions standards achievable. EPA requests comment on the proposed flexibilities individually and as a whole.

1. Overview of Approach to Providing Compliance Flexibilities

In this proposal, EPA has attempted to facilitate compliance by creating provisions that help avoid unnecessary hardship for engine and equipment manufacturers but that still achieve the desired environmental benefits. EPA believes that these provisions will help to avoid disruption of supplies of engines needed by equipment manufacturers and will enable both engine and equipment manufacturers to more easily and economically make the transition from Phase 1 to Phase 2. These provisions will also help ensure that the stringent standards proposed in the rule are achievable with technology that will be available during the Phase 2 time frame.

Some engine manufacturers have expressed concern that the Phase 2 program might be too burdensome for engine families with small volume production or for small volume manufacturers. These manufacturers have stated that, without some kind of relief, these burdens will lead them to stop producing certain engines rather than bear the additional costs. The engines most likely to be affected are special engines designed for niche markets. For these markets, there could be significant consequences to equipment manufacturers and operators if production of special engines were to cease. To address these concerns, EPA is proposing several compliance flexibilities intended especially to reduce the compliance burden on small volume products or small volume engine or equipment manufacturers.

2. Proposed Production Volume Cutoffs

EPA has developed proposed cutoffs to determine whether a manufacturer or engine/equipment family would qualify for the flexibilities proposed today. These cutoffs are described here, with a more detailed discussion in Chapter 9 of the Draft RSD. EPA decided not to propose the Small Business Administration's definition of "small business" as the criterion for a manufacturer to qualify for the proposed flexibilities (the

SBA definition is either 500 or 1000 employees, depending on the SIC code of the industry). This is because, of 15 engine manufacturers qualifying as "small business" by the SBA definition, at least three produce large volumes of engines, between 75,000 and 700,000 units, and have very high annual income. EPA believes these companies will not experience significant burdens in complying with the proposed Phase 2 program. Instead, EPA is proposing the following production volume cutoffs[50] for qualifying for the flexibilities proposed today.

First, nonhandheld engine manufacturers would be considered "small volume engine manufacturers" when their total annual production is 10,000 units or less; handheld engine manufacturers would be considered "small volume engine manufacturers" when their total annual production is 25,000 units or less. While over 50 percent of the nonhandheld engine manufacturers, and up to 30 percent of the handheld engine manufacturers could qualify under this proposed cutoff, fewer than 1 percent of the engines sold in the U.S. would be covered by these cutoffs.

Second, nonhandheld small volume engine families would be those families of 1000 units of less; handheld small volume engine families would be those families of 2,500 units of less. These proposed thresholds were selected as high enough to include approximately 30 percent of the engine families in each category, while low enough to account for less than 1 percent of the engines sold. At these levels, EPA believes a reasonable amount of flexibility could be provided to a significant number of manufacturers without undue risk of loss in emission control. In comments to the ANPRM, PPEMA has recommended 10,000 units or less as a definition for small volume hand held families. Since this definition will impact the number of engine families within a manufacturer that could be exempt from PLT testing, EPA is uncertain as to why a larger sales volume cut off is both appropriate from an enforcement perspective and of particular benefit to the manufacturer. EPA requests information on the necessity for expanding its small volume engine family definition to include larger volume family sales such as recommended by PPEMA (and a comparable volume for nonhandheld engine families), especially regarding the cost benefit to specific individual manufacturers and the impact such a higher number would have on the confidence EPA would have that its PLT compliance program adequately evaluates the emission performance of the manufacturer's production.

Third, equipment manufacturers using nonhandheld engines would be considered "small volume equipment manufacturers" when their total annual output across all models is 2500 units or less; equipment manufacturers using handheld engines would be considered "small volume equipment manufacturers" when their total annual output across all models is 5000 units or less. Again, while over 80 percent of the nonhandheld equipment manufacturers, and up to 67 percent of the handheld equipment manufacturers

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[50]Annual production volume of U.S. sales, as defined by these proposed regulations. Note that the vast majority of "small" manufacturers together produce a very small fraction of the engines; a few very large manufacturers produce the large majority of the engines.

could qualify under this proposed cutoff, fewer than 2 percent of the nonhandheld engines and 1 percent of the handheld engines sold in the U.S. would be covered under these thresholds.

Finally, equipment models using nonhandheld engines would be considered "small volume equipment models" when 500 or fewer units are produced per year; equipment models using handheld engines would be considered "small volume equipment models" when 2500 or fewer units are produced per year. On the nonhandheld side up to 3 percent of the equipment sold in the U.S. would be considered small volume equipment models. On the handheld side, up to 3.5 percent of the equipment sold in the U.S. would be considered small volume equipment models.

3. General Flexibilities

The program proposed today contains several general provisions intended to facilitate compliance for engine manufacturers. One proposed flexibility, available to both handheld and nonhandheld engine manufacturers, is the ability to carry-over certification from one year to the next. This would reduce certification costs after the first year for those engines using technology that does not change significantly from year to year.

In addition, today's proposal contains two sets of proposed standard structure flexibilities which differ for handheld and nonhandheld engine manufacturers. For handheld engine manufacturers, the standards proposed in today's rule would be phased in, on a percentage of sales basis, which would facilitate compliance by allowing a manufacturer to spread initial compliance costs out over several years. It would also provide an opportunity for engine manufacturers to continue to supply Phase 1 engines to various equipment manufacturers, including the small volume equipment manufacturers that would also benefit from the special flexibilities described below.

For nonhandheld engine manufacturers, a declining corporate average standard for Class II nonhandheld engines would achieve those same goals. In addition, nonhandheld engine manufacturers would benefit from the certification averaging, banking, and trading program, which would help reduce compliance costs by allowing manufacturers to meet the standards with the most cost-effective technologies. Today's proposal would also allow manufacturers of nonhandheld overhead valve engines to use an assigned deterioration factor for nonhandheld overhead valve engines, further easing the compliance burden by reducing the number of tests needed to determine compliance.

For equipment manufacturers, EPA is proposing that the current provisions of 40 CFR 90.1003(b)(4) applicable for the transition from uncontrolled to Phase 1 emission regulations would also apply in concept during the transition from Phase 1 to Phase 2. Under today's proposal, equipment manufacturers would be allowed to continue to use Phase 1 engines until their stocks of engines are depleted, provided they do not engage in "stockpiling" (i.e., build up of an inventory of engines outside of normal business practices).

4. Phase-In Flexibilities

In addition to these general flexibilities, EPA is proposing two other provisions that would be applicable to all manufacturers of certain kinds of nonhandheld engines to ease compliance during the phase-in of the standards and ensure their achievability. First, because manufacturers' testing capacities may be substantially constrained during the transition to fully-phased-in standards, EPA is proposing to allow manufacturers of Class II OHV nonhandheld engines who elect not to use assigned dfs to use good engineering judgment to establish deterioration factors for the 500 and 1000 hour useful life categories during the phase-in of the 12.1 g/kW-hr Class II standard, subject to the approval of the Administrator. Recognizing the need to verify deterioration factors established based on good engineering judgment, EPA is proposing that, beginning in 2006, the Administrator may direct manufacturers to verify such deterioration factors using the same process as that for calculating deterioration factors described in Section IV.D.1 above (i.e, aging at least three engines in the field and calculating the deterioration factor based on the average of the test data). EPA is also proposing that the manufacturer would be allowed to offset any emission shortfalls resulting from a low deterioration factor through the use of certification credits (see discussion, Section IV.A.5) or other compensating measures approved by the Administrator.

Second, EPA is proposing an additional flexibility for manufacturers of Class II nonhandheld engines that use side-valve technology engines or engines with aftertreatment. During the transition to the Phase 2 standards, for engines which the manufacturer commits to cease production by the end of the 2004 model year, manufacturers would have the option to age engines for less than their full useful lives and extrapolate the deterioration factor to the full useful life using good engineering judgment.[51] Again, demonstration of such good engineering judgment would need to be made to the satisfaction of the Administrator. For the engine families which the manufacturer commits to phase out, engines certified to 250 hours could be aged for 120 hours, engines certified to 500 hours could be aged to 250 hours, and engines certified to 1000 hours could be aged to 500 hours. This flexibility, like the previous one, is intended to reduce the testing burden during the phase-in of the 12.1 g/kW-hr standard. However, EPA is not proposing to extend this flexibility to Class II engines which the manufacturer does not commit to cease production. In essence, this flexibility is designed to reduce the compliance burden at the start of the program for engines that are to be phased out, and thus to allow manufacturer to focus their resources on transitioning to engines that will meet the 2005 standards.

5. Flexibilities for Small Volume Engine Manufacturers and Small Volume Engine Families

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[51]As described in Section IV.D.1 of this preamble, Class II side-valve engines and engines with aftertreatment would be able to certify through a bench aging certification program, provided that a field/bench adjustment factor had been established.

EPA is proposing five compliance flexibilities to ensure the achievability of the standards and reduce the compliance burden on small volume engine manufacturers and small volume engine families, as follows.

First, small volume engine manufacturers could opt out of mandatory production line testing. This option would apply only to nonhandheld engine manufacturers with a total annual production of 10,000 engines or less and to handheld engine manufacturers with a total annual production of 25,000 engines or less. These engines would be subject to SEA testing. However, EPA anticipates little such testing unless it receives evidence of nonconformities or other problems.

Second, manufacturers of small volume nonhandheld engine families (those with total annual production of 1000 engines or less) and manufacturers of small volume nonhandheld engine families (those with total annual production of 2500 engines or less) could opt out of mandatory production line testing for those engine families. As above, these engines would remain subject to SEA testing, which would likely only occur if EPA had evidence of nonconformity.

Third, manufacturers of very clean engine families, that is, those whose HC+NOx certification levels are at least 50 percent below the standard (or FEL, if applicable) could also opt out of mandatory production line testing for those families. These engines would also be subject to SEA testing, although EPA sees little likelihood of conducting SEAs on engines certified substantially below the standard (or FEL). EPA seeks comment on the margin below the standard (or FEL) necessary to qualify for this exemption.

Fourth, small volume Class II side-valve technology engine families (whose annual production is 1,000 engines or less) would be allowed to meet an HC+NOx standard of 24 g/kW-hr, which represents the Phase 1 standard adjusted for deterioration. Note that these families could also opt out of mandatory production line testing, consistent with provision 2 above. This flexibility is intended to ensure that manufacturers can continue to produce these small volume engines, many of which are used in niche-market specialty equipment.

Fifth, small volume engine manufacturers could defer compliance with Phase 2 handheld requirements and Class II nonhandheld standards until the last year of the phase in. For handheld engines, this would mean that the engine manufacturer could, at its option, produce Phase 1 engines exclusively through the 2004 model year, with full Phase 2 compliance required in 2005. For nonhandheld Class II engines, the engines would be subject to the Phase 2 requirements beginning in 2001, but would not have to comply with the actual Phase 2 corporate average standards until the 2005 model year. These manufacturers could certify Class II engines to a standard of 24 g/kW-hr through 2004. These engines would neither use nor generate certification credits. If a small volume engine manufacturer desired to generate credits prior to the 2005 model year, it could do so for those engines certified below the applicable corporate average emission standard. Note that, consistent with the first provision above, these families would not have to be tested under mandatory production line testing. This flexibility is intended to provide another mechanism to reduce impact on small volume engine manufacturers and help ensure that manufacturers can continue to produce engines for specialty equipment.

EPA is not proposing to specifically exempt from in-use testing any group of engines to which in-use testing requirements are applicable based on the group's or the manufacturer's size. The Agency believes that all engines should meet their standards (or FELs, as applicable) for their full useful life and that manufacturers should design engines to be emission durable. It is therefore appropriate that all engines to which in-use testing or demonstration requirements are applicable be subject to in-use testing. However, under this proposal, the choice of engines which would require in-use testing or demonstration is EPA's. EPA would not be inclined to identify for mandatory in-use testing a very small volume engine family or a family certified by a very small company unless there was evidence of a nonconformity. EPA requests comment on the appropriateness of this position.

6. Flexibilities for Small Volume Equipment Manufacturers and Small Volume Equipment Models

Several equipment manufacturers who do not make their own engines have expressed concern that the transition to the Phase 2 program may disrupt their production because engine suppliers do not always provide adequate lead time for equipment redesigns needed to accommodate engine design changes. Engine changes could affect mounting and connection locations, heat rejection loads, and engine compartment requirements, for example. In addition, some equipment manufacturers cannot implement equipment design changes quickly, even with timely information from manufacturers because of the sheer volume of redesign work needed to change diverse product offerings with limited engineering staffs.

EPA believes that the engine manufacturer flexibilities described above will extend the availability of engines currently used by small volume equipment manufacturers and will help ease the transition from Phase 1 to Phase 2 for those entities. However, to respond more directly to concerns raised by equipment manufacturers, EPA is proposing three compliance flexibilities to help enable equipment manufacturers to make the transition from Phase 1 to Phase 2 engines.

First, EPA is proposing to temporarily exempt small volume equipment manufacturers from the requirement to use Phase 2 engines in cases where no Phase 2 engines with appropriate physical and performance characteristics are available to fit existing equipment models. This exemption would apply to those equipment manufacturers whose annual output across all models uses 2500 or fewer nonhandheld engines, or 5000 or fewer handheld engines, and would last through the third year after the last applicable phase-in date for that class of engines. Thus, for example, small volume equipment manufacturers who use Class II nonhandheld engines in an existing piece of equipment could continue using Phase 1 engines through the end of the 2008 model year, in cases where no suitable Phase 2 engines are available to fit existing equipment models.

Second, EPA is proposing to delay the impact of the Phase 2 requirements on individual small volume equipment models in cases where no suitable Phase 2 engines are available to fit existing equipment models. A small volume model, as proposed, is one

with 500 or less units produced per year for nonhandheld equipment, and 2500 or fewer units produced per year for handheld equipment. These small volume models could continue to use Phase 1 engines throughout Phase 2, except as discussed below. EPA is proposing that this exemption would be allowed only for those equipment models in which a certified Phase 2 engine will not fit, and would apply only to models in production prior to the effective date of the Phase 2 standards. This is to avoid encouraging manufacturers to bring out new models designed to use Phase 1 engines after the Phase 2 standards have gone into effect. This exemption would also apply only so long as the equipment is not significantly modified. EPA believes that if the equipment manufacturer takes steps to significantly redesign a particular model, the use of a Phase 2 engine should be included. Finally, this exemption could apply only through the applicability of the Phase 2 program. EPA seeks comments on each of these restrictions, especially with regard to how they would affect equipment manufacturers who might incur a significant change in the cost of the engine if they were required to switch to a Phase 2 engine as the result of a significant model redesign.

Finally, EPA is proposing a hardship relief provision by which any equipment manufacturer could obtain relief to continue using Phase 1 engines, by demonstrating to the Administrator's satisfaction that, despite its best efforts, the manufacturer cannot meet the implementation dates without incurring substantial economic hardship, even with the transition flexibilities described above, due to unforeseeable factors beyond the equipment manufacturer's control. Such a situation may occur if an engine supplier were to change or drop an engine model very late in the implementation process. The intent of this provision is to recognize the concerns of equipment manufacturers about the uncertainty of timely supply of engines that meet equipment requirements by providing fair, objective criteria for hardship appeal that minimize the potential loss in environmental benefit, minimize the Agency's involvement in the financial affairs of the affected equipment manufacturer, and avoids straining the Agency's resources.

As proposed, this hardship relief provision would require requests to be made in writing, submitted before the earliest date of noncompliance, include evidence that failure to comply was unforeseeable and was not the fault of the equipment manufacturer (such as a supply contract broken by the engine supplier), and include evidence that the inability to sell the subject equipment will have a major impact on the company's solvency. The Agency would work with the applicant to ensure that all other remedies available under the flexibility provisions are exhausted before granting further relief, and would limit the period of relief to no more than one year. Furthermore, the Agency proposes that applications for hardship relief could only be submitted through the first year after the last effective date of the phase-in period. EPA seeks comment on all aspects of this flexibility provision and on whether the Agency should require those who receive relief to cover some of the lost environmental benefit, such as purchasing lower emitting engines.

7. Engine Availability

EPA recognizes that the above-described equipment manufacturer flexibility

provisions are of little use if Phase 1 engines are not available. Therefore, to help ensure availability of Phase 1 engines necessary for the above relief provisions to have full effect, EPA is proposing that engine manufacturers be allowed to build and sell the engines needed to meet the market demand created by these flexibilities. Specifically, EPA is proposing to continue to apply the Phase 1 compliance provisions to these engines. Thus, these Phase 1 engines would not be subject to Phase 2 useful life, production line testing or in-use demonstration requirements contained in today's program, since Phase 1 engines are not currently subject to those provisions. EPA desires to minimize any disincentives that engine manufacturers may have to producing these engines for small volume equipment users and is therefore proposing that these engines would be counted only to the extent necessary to determine the availability of the specific flexibility item that was being applied. These engines would not count in any other calculation of compliance with phase in requirements or against any other ceilings or limits proposed in this rule. These engines would not be required to use any emission credits nor would they be permitted to generate any such credits.

However, to prevent abuse of the ability to continue to produce Phase 1 engines, EPA believes it is necessary to impose some restrictions on the continued manufacture and sale of those engines. Therefore, EPA is proposing that equipment manufacturers procuring engines for use under the flexibility programs described above provide written assurance to the supplying engine manufacturer that such engines are being procured for this purpose. EPA requests comment on the need for a requirement that engine manufacturers maintain or annually provide to EPA records on the engines manufactured in support of the equipment manufacturer flexibilities described above, or whether EPA should rely on equipment manufacturer records.

F. Nonregulatory Programs

The following is a description of three nonregulatory programs which, though outside of the scope of the regulation, could yield important environmental benefits from the small SI engine sector. The first program is a voluntary incentive and recognition program for low-emitting nonhandheld and handheld engines, which would take the form of a "green labeling" program to identify engines which have emissions significantly lower than required by the proposed standards. The second program is a voluntary fuel spillage reduction program for nonhandheld and handheld engines. The third program is a particulate matter (PM) and hazardous air pollutant (HAP) testing program for handheld engines. These programs are described in the remainder of this section.

1. Voluntary "Green" Labeling Program

EPA is very interested in encouraging the design, production, and sale of small engines which are substantially cleaner than would be required by today's proposed Phase 2 programs. EPA plans to implement a voluntary program which would include consumer labeling of engines and equipment with superior emission performance as a way of providing public recognition and also allowing consumers to easily determine

which engines have especially clean emission performance. At this time, EPA is considering a threshold of around 50 percent of the proposed standard (e.g., around 12.5 g/kW-hr for Class I engines) as the level below which engines would qualify for "green" labeling. To develop the details of such a program, the Agency requests comment on all aspects of the program, including the threshold for determining a "green" engine, whether the sales weighted certification level after dfs are applied should be used to establish the eligibility of an engine family, the design of and information to be included on the label, and other matters relevant to the successful implementation of the program. The Agency requests comment on program recommendations as part of today's proposal. In particular, the Agency seeks information on when such a program must be in place to effectively impact the sale of especially clean Phase 2 engines. The Agency is interested in working closely with consumer groups, engine and equipment manufacturers and others with an interest in making this program work. The Agency invites comment on the interest of any of these groups in working with the Agency to develop and implement this program.

2. Voluntary Fuel Spillage and Evaporative Emission Reduction Program

EPA is planning to develop a voluntary fuel spillage and evaporative emission reduction program specifically for the small engine industry and its customers. While this program would not impose enforceable requirements on engine manufacturers subject to this rulemaking, it is important to reduce fuel spillage and other sources of evaporative emissions. Every year, millions of gallons of gasoline are lost during refueling. It is estimated that if a few ounces are spilled during each refueling of lawn and garden equipment, they would total about 17 million gallons of gasoline, most of which evaporates into the air to contribute to the ground-level ozone problems. To reduce and prevent this pollution, a variety of measures will be needed, most involving increased public awareness and education.

The Agency believes it is appropriate to develop and implement a program targeted at the small SI industry and its customers to encourage public awareness and act as an incentive for technology investments. The Agency is interested in a voluntary partnership program which would involve EPA, engine manufacturers and equipment manufacturers, regional, state, and local air pollution agencies, health and environmental organizations, fuel container manufacturers, and other interested parties who would all contribute to the successful development and implementation of a voluntary fuel spillage and evaporative emission reduction program.

While the design of such a program will benefit from the thoughtful input of all partners, the program would likely encourage the development of technology that will assist equipment users in reducing spills and evaporative emissions, provide recognition for implementing technology developments that will assist equipment users in reducing spills, and provide education and training to commercial operators of equipment and to those persons who influence individuals doing the refueling (such as equipment sales staff or small engine course instructors), and similar target audiences.

Initial steps in this program involve identifying interested partners and convening a meeting to discuss the roles and responsibilities of each partner. The Agency seeks comment on the proposed voluntary partnership program, interest in participating in this partnership, appropriate strategies and target audiences, and other matters pertinent to establishing this program.

3. Particulate Matter and Hazardous Air Pollutant Testing Program

While section 213(a)(4) of the Clean Air Act allows EPA to establish standards for nonroad emissions of any air pollution which may reasonably be anticipated to endanger public health or welfare, today's notice does not propose to establish emission standards in Phase 2 for particulate matter (PM) or non-hydrocarbon hazardous air pollutants (HAP) listed under section 112 (b) of the Clean Air Act. However, EPA and other parties have agreed that a PM and HAP test program will be conducted (see 62 FR 14746). The Portable Power Equipment manufacturers Association (PPEMA), in cooperation with EPA, will conduct a test program to evaluate and quantify emissions of PM and HAP including, but not limited to, formaldehyde, acetaldehyde, benzene, toluene, and 1,3 butadiene. EPA anticipates that testing will be conducted on Phase 2 technology handheld engines, with a sufficient magnitude of engines tested to represent the range of new basic technologies used to comply with Phase 2 small engine standards. EPA expects that the information generated by this program will be useful in informing any future implementation of section 213(a)(4) regarding small SI engines.

G. General Provisions

This section includes a description of certain other general provisions proposed in today's notice, including provisions related to annual production period flexibilities during the transition to Phase 2, the definition of handheld engines, a small displacement nonhandheld engine class, propane fueled indoor power equipment, dealer responsibility, engines used in recreational vehicles, engines used in rescue and emergency equipment, and replacement engines.

1. Model Year Definition and Annual Production Period Flexibilities During Transition to Phase 2

The programs for nonhandheld and handheld engines proposed today would be effective beginning with the 2001 and 2002 model years, respectively. EPA is not proposing to change the Phase 1 definition of model year for Phase 2. That is, model year (MY) would continue to mean the manufacturer's annual new model production period which includes January 1 of the calendar year, ends no later than December 31 of the calendar year, and does not begin earlier than January 2 of the previous calendar year. When a manufacturer has no annual new model production period, model year would mean calendar year (see 40 CFR 90.3). Under no circumstances would the model year definition be allowed to be interpreted to let existing models "skip" annual

certification by pulling ahead the production of every other model year.

In addition, in order to provide additional lead time for the implementation of the program for nonhandheld engines, EPA is proposing to adopt similar flexibilities for the beginning of the Phase 2 program for nonhandheld engines as were available for the Phase 1 program (see 40 CFR 90.106 (a) and (b)). Thus, for the start up of Phase 2, EPA is proposing that every manufacturer of new nonhandheld engines produced during or after model year 2001 would be required to certify those engines to the Phase 2 program requirements. Nonhandheld engines manufactured during an annual production period beginning prior to September 1, 2000, would be allowed to certify to Phase 1 standards. However, annual production periods beginning prior to September 1, 2000, would not be allowed to exceed 12 months in length. In effect, all nonhandheld engine families would be required to be certified to the Phase 2 program by September 1, 2001. EPA is not proposing this provision for handheld engines, which have both a later effective date as well as a phase-in of the Phase 2 program based on percentage of engine sales. EPA requests comment on whether similar provisions for handheld engines should be adopted (except that in the case of handheld engines, September 1 of each year would be the date that the percentage of engine sales requirements for Phase 2 certification would have to be met). EPA requests comments on all aspects of these provisions relating to annual production periods in the transition from Phase 1 to Phase 2 certified engines.

2. Definition of Handheld Engines

EPA is not proposing any changes to the criteria listed in Phase 1 used to determine whether engines could be classed as Class III, IV or V. For Phase 2, EPA would continue to make determinations of applicability of the Class III, IV, or V standards based on the criteria found at 40 CFR 90.103(a)(2). During Phase 1, the multipositional use criterion has been used by EPA to make handheld determinations for certain two-person earth augurs, breakers and rammers, and power shovels. In each case, the manufacturer presented evidence to the satisfaction of the Agency demonstrating the multipositional use of the equipment, and provided a discussion of any constraints on engine design imposed by the usage of the equipment. The interpretation of multipositional use by EPA has been made relative to the equipment category and the technology available to meet the constraints imposed by the usage of the equipment.

EPA received comment on the ANPRM that EPA should revise the definition of handheld.[52] This commenter suggests that the Phase 1 definition of handheld restricts the replacement of 2-strokes by significantly cleaner 4-stroke engines, making it difficult to introduce a significantly cleaner engine for a product application. This commenter suggests that a different handheld definition and interpretation would improve the environment and permit the continued use of necessary products.

EPA believes that the current interpretation of criteria used to determine

[52]See comments from Honda, Item #II-D-07 in EPA Air Docket A-96-55.

applicability of Class III, IV and V standards addresses this concern. Provided the 4-stroke engines are capable of performing the same intended functions as 2-stroke engines used in similar handheld applications, then EPA would likely determine that the 4-stroke engine also meets the criteria for applicability of the Class III, IV or V standards.

3. Small Displacement Nonhandheld Engine Class

EPA has considered whether there is a need for changes or additions to the five classes of small SI engines for regulatory purposes. In particular, the Agency has considered whether there is a need for addition of a new, small displacement class that would be considered "nonhandheld." In comments on the ANPRM, one commenter specifically requested EPA to consider proposing a new class, as follows: the new class would be nonhandheld engines with displacements less than 75cc, and be subject to an in-use standard of 72.4 g/kW-hr with useful life categories of 125 hours and 250 hours. The commenter believes a new class for nonhandheld is needed for several reasons. The commenter believes the existing Phase 1 standards did not contemplate small displacement nonhandheld engines, yet the Phase 1 rule left a void in the market which could be filled by small displacement nonhandheld engines. The commenter believes the Phase 1 standards prevented less than 75 cc 2-stroke engines from being certified into some nonhandheld applications which utilize small displacement engines, but that the proposed Phase 2 Class I standard is too stringent for less than 75 cc 4-strokes to meet.

The Agency is not proposing the addition of a new small displacement nonhandheld class. The Agency believes that the proposed Class I standard, which can be met through averaging, will allow a full range of small displacement nonhandheld engines to certify to the proposed Phase 2 standards. If the proposed Class I standard can be met through averaging, the creation of a new displacement class with a higher standard could result in a smaller environmental benefit from the Phase 2 program.

The Agency understands it is possible that some nonhandheld applications which use small displacement engines may no longer be able to utilize two-stroke engines if the Phase 2 standards are adopted as proposed, but believes that complying engines, perhaps of larger displacement, can be used. EPA requests additional information on this issue and the extent of its occurrence. The Agency also once again requests comment on the need for a new small displacement class, in particular, whether the proposed average Class I standard is sufficient to cover smaller displacement engines. The Agency also requests comment on the displacement cutoff (75cc), standard (72.4g/kW-hr), and useful lives (125 hours and 250 hours) suggested by the ANPRM commenter.

4. Liquefied Petroleum Gas Fueled Indoor Power Equipment

Manufacturers of equipment using liquefied petroleum gas (LPG) have argued that their situation deserves special consideration within the Phase 2 regulations.[53] The

[53]See EPA Air Docket A-96-55, Items #II-D-02, II-D-04, and II-D-08.

type of equipment they produce is often designed specifically for indoor use including, for example, floor washing and buffing equipment. The relatively low sales (likely fewer than 10,000 annually nationwide for the industry) and the fact that many of these manufacturers likely sell less than one thousand pieces of equipment annually means that both individually and collectively they account for a very small portion of the small SI engines sold annually. LPG is a popular fuel for indoor equipment due to the proven ability to calibrate LPG-fueled engines to operate at very low carbon monoxide (CO) levels. Low CO performance is especially important for indoor equipment to minimize CO exposure to the operator and others in the building. The Occupational Health and Safety Administration (OSHA) has set maximum CO standards for indoor ambient concentrations and some states have adopted even tighter indoor CO standards. While these are ambient standards, not emission limits for individual pieces of equipment, equipment manufacturers, to successfully market in this area, must be assured their equipment emits very low levels of CO and thus can be routinely used indoors without causing violations of OSHA or state indoor air quality requirements.

Because the specialized nature of their equipment places unique demands on these engines and due to the typically low sales volumes of many of the pieces of equipment, many of these indoor equipment manufacturers must not only design and produce their equipment but also to a significant extent are responsible for the modification of engines to power their equipment. In a number of cases these indoor equipment manufacturers buy gasoline-fueled engines and convert them to operate on LPG.

While manufacturers of LPG-fueled indoor power equipment must power their equipment with engines which meet all the requirements of the small engine Phase 1 rules, the manufacturers argue that the proposed Phase 2 rules would add significantly to their burden. While meeting the proposed federal HC+NOx Phase 2 standard should not be particularly difficult for LPG engines compared to gasoline-fueled engines, the combined need to also achieve very low CO emission levels in order to not cause violations of indoor ambient CO standards may present a design challenge. The necessary controls may well exceed those required to meet just the Phase 2 standards and may include, for example, the use of electronically controlled fuel systems and perhaps catalysts. This could add significant cost to a relatively few engines. Even at a higher cost, those equipment manufacturers currently being supplied LPG-fueled engines by an original engine manufacturer are concerned that their suppliers may decide it is not worth the effort to supply engines complying with the Phase 2 standards. For those equipment manufacturers modifying engines to operate on LPG at low CO levels, the same technical challenges are faced while their ability to spread the development costs across their engines is limited by the low number of engines modified.

While EPA has not done a thorough cost analysis for the impact of Phase 2 standards on this unique segment of the industry, EPA is persuaded that the technical challenges faced by this segment are significant. Many of these manufacturers would be considered “small volume engine manufacturers”, with engines produced in “small volume engine families”, under the criteria proposed today, and would therefore qualify for proposed compliance flexibilities for small volume engine manufacturers and small

volume engine families. These include both additional flexibilities in the phase-in of the Phase 2 standard, and also an option to opt out of mandatory production line testing. In effect, the additional phase-in flexibilities would allow nonhandheld manufacturers of indoor LPG-fueled power equipment engines, whose annual production of small SI engines is 10,000 units or less, to continue producing Class II nonhandheld engines which meet a Phase 1 equivalent standard (24 g/kW-hr) until 2005. Beginning in 2005, when the Phase 2 standards are proposed to be fully phased in for gasoline-fueled engines, these LPG-fueled engines are proposed to also be required to meet the Phase 2 HC+NOx standards. This extra lead time would allow manufacturers to spread their development efforts over several additional years, for those manufacturers choosing or required to make their own fuel modifications. In addition, while these engine families would be certified to the Phase 2 program, the cost of the proposed compliance program for these manufacturers would be minimized, as these manufacturers and engine families would likely qualify for the proposed flexibilities that would allow manufacturers to carry-over certification from one year to the next and to opt out of mandatory production line testing. The provisions for small volume engine manufacturers and small volume engine families are discussed in more detail in Section IV.E.

Comments are requested on the impact of this proposed phase-in flexibility and other proposed compliance program flexibilities on the technical and economic ability of the indoor power equipment engine industry segment to successfully comply with the Phase 2 standard beginning in 2005, and any air quality impact concerns such a delayed implementation might cause.

EPA is also requesting comment on the possible deletion of the existing §90.1003 (b)(3). EPA believes this provision may be of only limited utility for this program and believes it could prove problematic for small SI engines. This provision provides that certain activities connected to conversion of engines to alternative fuels will not be regarded as tampering. At one point, the existing regulatory paragraph makes reference to "vehicle" standards, of which, of course, there are none in the small SI program. Further, it might be misconstrued as requiring an engine modifier to reinstall hardware that was removed in the conversion process after the conversion was complete. Under such a misreading, a modifier engaged in converting gasoline engines to operate on propane might be viewed as having to reinstall the original gasoline carburetor on an engine after conversion, even if that were not feasible.

Existing converters of small SI engines are currently certifying their products on the alternative fuel or are operating under EPA's tampering enforcement Memorandum 1-A. In light of this, for small SI engines, EPA believes that the discussion of the tampering implications of alternative fuel conversions for small SI engines could be best handled by the application of Memorandum 1-A. EPA does not expect that existing engine modifiers would be harmed by the deletion of this paragraph.

Text similar to existing §90.1003 (b)(3) is found in other nonroad rules. EPA intends, at some future date, to review the appropriateness and usefulness of this language in those rules.

5. Dealer Responsibility

This proposal contains no new constraints or responsibilities for dealers and repair facilities from the Phase 1 rule. Dealers and repair shops, like all other persons, would continue to be prohibited from tampering or causing tampering. Tampering refers to the removal or rendering inoperative of any device or element of design installed on or in an engine for purposes of emission control.

During the Phase 2 regulatory negotiation process, the issue of dealer responsibility was frequently raised out of concern that increasingly sophisticated control technologies would result in greater numbers of tampered engines being brought in for service. Another concern was that the Phase 2 rule not require that repair parts for emission control systems be obtained from the engine manufacturer.

While all persons, including dealers and repair facilities, are prohibited from tampering or causing tampering, they are not prohibited from working on tampered engines. Under EPA tampering policies, dealers and repair facilities are not expected to restore tampered products to their originally certified and functioning configuration unless the repair is to the tampered system or a component of the tampered system. In such a case, the dealer or repair facility should restore the system to a certified and properly functioning condition, but need not conduct emission testing to verify compliance with emission standards. With regard to the use of emission control repair parts, dealers and repair facilities may use parts represented by their manufacturers to be functionally equivalent to original equipment parts.

6. Engines Used in Recreational Vehicles

EPA is not proposing any changes to the provision in the Phase 1 rule that engines used in recreational vehicles would not be subject to the small SI engine regulations. EPA continues to believe that these engines are more appropriately regulated under a rulemaking separate from this small SI engine program. Thus, these engines would remain outside the scope of the program when Phase 2 takes effect. The Agency's rationale for excluding engines used to propel recreational vehicles was presented in the preamble for the Phase 1 Notice of Proposed Rulemaking (NPRM) (see 59 FR 25403, 25414), and the Agency addressed the comments received on this topic in the Phase 1 Response to Comments document (see Section 3.8 "Non-Coverage of Recreational Propulsion Engines", EPA Air Docket A-93-25, Docket Item V-C-01). As discussed in the Preamble for the Phase 1 NPRM, "EPA's primary reason for this exclusion is the extremely transient operation of the products in which these engines are used, which limits the ability of the proposed steady state test procedure to adequately represent exhaust emissions. This exclusion is not based on a determination that these engines do not contribute to air pollution and therefore need not be controlled." (59 FR 25414) EPA continues to be concerned that the test procedures covering the Phase 1 and Phase 2 engines may not be appropriate for engines used to propel recreational vehicles.

Engines used in recreational vehicles are defined at 40 CFR 90.1(b)(5), in part, as having a rated speed greater than or equal to 5,000 RPM and having no installed speed governor. While EPA is not proposing any changes to the provisions which exclude recreational vehicles from this rule, EPA does wish to clarify that some engines with

installed "speed governors" and with ungoverned rated speed above 5000 rpm still qualify as recreational. For example, engines used in typical recreational vehicles such as snowmobiles and 4-wheel ATVs which, when designed for use by children have "speed governors" installed for safety purposes to limit the top speed of the vehicle, have been found by EPA to be "recreational vehicles" in implementation of Phase 1. These vehicles are still operated in a typical fashion for recreational vehicles up to that top speed. During the development of the Phase 1 rule, the Agency was not aware of the existence of snowmobiles designed for children, and therefore not aware of the existence of snowmobiles with "speed governors." The Agency would like to clarify that EPA continues to believe snowmobiles should not be covered under this rule, including snowmobiles designed for use by children which may in fact have a "speed governor" installed for safety purposes.

7. Engines Used in Rescue and Emergency Equipment

In consideration of safety factors associated with compliance with the Phase 2 program, today's proposal includes a provision that would exempt engines which are used exclusively in emergency and rescue equipment from compliance with any standards if the equipment manufacturer can demonstrate that no certified engine is available to power the equipment safely and practically. Although under Phase 1 EPA has received no reports of problems caused by the need to use certified engines in emergency and rescue equipment, EPA is concerned that such problems could arise. EPA foresees this exemption applying especially to handheld items used to work in tight places to perform such tasks as cutting metal to extricate passengers from wrecked vehicles, if the size, heat or other characteristics of the certified engine would render its use unsafe. EPA does not foresee this exemption applying to portable generators, compressors or hydraulic pumps that may be used to power rescue equipment from a distance, since such devices are not as subject to the size, weight and other considerations surrounding a tool that contains its own source of power.

EPA proposes this exemption to avoid any possible conflict between emission control and public safety. EPA wishes to reduce the chance that a piece of rescue equipment will go out of production or become more cumbersome because of the need to use certified engines. EPA sees no significant air quality impact from such an exemption, because it would apply only to engines that are few in number and are subject to infrequent use for very short periods of time. In fact, EPA is not currently aware of any engine that is used exclusively in emergency or rescue equipment. The exemption, as proposed, would apply to engines and equipment produced during the remainder of the Phase 1 period as well as Phase 2 engines and equipment.

8. Replacement Engines

After promulgation of the Phase 1 rule, equipment manufacturers approached EPA with concerns that, once the rule took effect, they would not be able to obtain replacement engines to repair certain items of more expensive equipment such as

commercial mowing and construction equipment when their engines fail. The equipment manufacturers provided evidence that many Phase 1 engines, especially Class II nonhandheld engines, would be configured differently from uncertified engines and would not fit in the engine compartments of some pre-regulatory equipment. The equipment manufacturers explained that occasional engine failures are often best remedied by replacing the engine. Commercial operators, many of whom are small businesses, may not be able to afford the downtime associated with waiting for an extensive engine repair. In effect, repairing the engines becomes more costly than replacing the engines, and may be less environmentally beneficial. EPA evaluated these concerns and gathered information from engine manufacturers, equipment manufacturers and their associations. EPA concluded that permitting the sale of uncertified replacement engines, which likely constitute less than one percent of annual small SI engine sales, was a cheaper alternative that was no worse for air quality than the repair or rebuilding of the failed engines, which were not prohibited by the Phase 1 rule. On August 7, 1997 (62 FR 42638), EPA issued a direct final rule amending the Phase 1 rule to allow engine manufacturers to sell uncertified engines for replacement purposes subject to certain controls designed to prevent abuse.[54] These controls require that the engine manufacturer ascertain that there is no currently certified engine that will fit in the equipment, that the engines be labeled for replacement purposes only, and that the engine manufacturer or its agent take ownership and possession of the old engine.

An environmental group has recently expressed concern to EPA about the replacement engine provisions for small SI engines published in the direct final rule described above. This group recommends that additional constraints and controls should be placed on the sale of these engines to prevent abuse since these engines either will not be built to comply with any standards, or will be built to comply with Phase 1 standards after those standards have been superseded by Phase 2 standards.

In today's notice, EPA is proposing to continue the replacement engine provision with an accommodation necessary to address Phase 1 engines after the implementation of Phase 2. EPA is also proposing additional requirements to address the concerns of the environmental group and better ensure that the ability to use replacement engines is not abused.

During Phase 2, the universe of small SI engines will expand to include uncertified engines, Phase 1 engines and Phase 2 engines. Consequently, the provision as proposed would be amended to permit uncontrolled engines to be sold for pre-regulatory equipment, and Phase 1 engines to be sold for equipment built with Phase 1 engines, subject to certain constraints. EPA has no reason to believe that this provision will result in significant adverse air quality impacts. In fact, many replacement engines for older equipment will be certified Phase 2 engines. This provision provides flexibility and cost savings for equipment operators. It affects primarily commercial equipment where the

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[54]The docket for this rulemaking, EPA Air Docket #A-97-25, is incorporated by reference.

equipment cost is high enough to justify major engine repairs or replacement and the usage of the equipment is such that downtime for repairs is costly. Replacement engines are not typically used in handheld equipment, nor in lower cost nonhandheld items such as walk behind mowers. A more detailed discussion of the rationale for the replacement engine provision can be found in the preamble to the direct final rule cited above.

Although EPA does not believe that replacement engines will cause any significant air quality impacts, it is proposing to add safeguards and reporting and record keeping requirements to further ensure against abuse. EPA is proposing to amend the existing replacement engine provisions to require: (1) that manufacturers follow specific guidelines when ascertaining that no certified engine is available which can suitably repower a specific item of equipment; (2) that old engines being replaced are destroyed; (3) that engine manufacturers report to EPA annually the number of uncertified engines sold under the replacement engine provisions; (4) that manufacturers keep records, accessible to EPA, of the purchasers, quantities and equipment applications of replacement engines; and (5) that there be a limit on the time period for which uncertified replacement engines are normally available. EPA requests comment on the need for these additional requirements, and the burden they may pose to industry, equipment operators and engine distributors.

V. Environmental Benefit Assessment

National Ambient Air Quality Standards (NAAQS) have been set for criteria pollutants which adversely affect human health, vegetation, materials and visibility. Concentrations of ozone (O_3) are impacted by HC and NOx emissions. Ambient concentrations of CO are, of course, impacted by CO emissions. EPA believes that the standards proposed today would reduce emissions of HC and NOx and help most areas of the nation in their progress towards compliance with the NAAQS for ozone. The following provides a summary of the roles of HC and NOx in ozone formation, the estimated emissions impact of the proposed regulations, and the health and welfare effects of ozone, CO, hazardous air pollutants, and particulate matter.

Much of the evaluation of the health and environmental effects related to HC, NOx and CO found in this section is also discussed in the draft Regulatory Support Document (RSD), and in the March 1997 ANPRM. EPA encourages comments on the Agency's beliefs expressed in this proposal and in the RSD, a copy of which is in the public docket for this rulemaking.

A. Roles of HC and NOx in Ozone Formation

Both HC and NOx contribute to the formation of tropospheric ozone through a complex series of reactions. In a recent report, researchers emphasize that both HC and

NOx controls are needed in most areas of the United States.[55] EPA's primary reason for controlling emissions from small SI engines is the role of their HC emissions in forming ozone. Of the major air pollutants for which NAAQS have been designated under the CAA, the most widespread problem continues to be ozone, which is the most prevalent photochemical oxidant and an important component of smog. The primary ozone NAAQS represents the maximum level considered protective of public health by the EPA. Ozone is a product of the atmospheric chemical reactions involving oxides of nitrogen and volatile organic compounds. These reactions occur as atmospheric oxygen and sunlight interact with hydrocarbons and oxides of nitrogen from both mobile and stationary sources.

A critical part of this problem is the formation of ozone both in and downwind of large urban areas. Under certain weather conditions, the combination of NOx and HC has resulted in urban and rural areas exceeding the national ambient ozone standard by as much as a factor of three. Thus it is important to control HC over wider regional areas if these areas are to come into compliance with the ozone NAAQS.

B. Health and Welfare Effects of Tropospheric Ozone

Ozone is a powerful oxidant causing lung damage and reduced respiratory function after relatively short periods of exposure (approximately one hour). The oxidizing effect of ozone can irritate the nose, mouth, and throat causing coughing, choking, and eye irritation. In addition, ozone can also impair lung function and subsequently reduce the respiratory system's resistance to disease, including bronchial infections such as pneumonia.

Elevated ozone levels can also cause aggravation of pre-existing respiratory conditions such as asthma.[56] Ozone can cause a reduction in performance during exercise even in healthy persons. In addition, ozone can also cause alterations in pulmonary and extrapulmonary (nervous system, blood, liver, endocrine) function.

The newly revised primary NAAQS[57] for ozone based on an 8-hour standard of 0.08 parts per million (ppm) is set at a level that, with an adequate margin of safety, is protective of public health. EPA also believes attainment of the new primary standard will substantially protect vegetation. Ozone effects on vegetation include reduction in agricultural and commercial forest yields, reduced growth and decreased survivability of tree seedlings, increased tree and plant susceptibility to disease, pests, and other environmental stresses, and potential long-term effects on forests and ecosystems.

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[55]National Research Council, Rethinking the Ozone Problem in Urban and Regional Air Pollution, National Academy Press, 1991.

[56]United States Environmental Protection Agency, *Review of the National Ambient Air Quality Standards for Ozone - Assessment of Scientific and Technical Information: OAQPS Staff Paper*, EPA-450/2-92-001, June 1989, pp. VI-11 to 13.

[57]See 62 FR 38896, Friday, July 18, 1997.

High levels of ozone have been recorded even in relatively remote areas, since ozone and its precursors can travel hundreds of miles and persist for several days in the lower atmosphere. Ozone damage to plants, including both natural forest ecosystems and crops, occurs at ozone levels between 0.06 and 0.12 ppm.[58] Repeated exposure to ozone levels above 0.04 ppm can cause reductions in the yields of some crops above ten percent.[59] While strains of some crops are relatively resistant to ozone, many crops experience a loss in yield of 30 percent at ozone concentrations below the pre-revised primary NAAQS.[60] The value of crops lost to ozone damage, while difficult to estimate precisely, is on the order of $2 billion per year in the United States.[61] The effect of ozone on complex ecosystems such as forests is even more difficult to quantify. However, there is evidence that some forest types are negatively affected by ambient levels of ozone.[62] Specifically, in the San Bernadino Mountains of southern California, ozone is believed to be the agent responsible for the slow decline and death of ponderosa pine trees in these forests since 1962.[63]

Finally, by trapping energy radiated from the earth, tropospheric ozone may contribute to heating of the earth's surface, thereby contributing to global warming (that is, the greenhouse effect), [64] although tropospheric ozone is also known to reduce levels of UVB radiation reaching the earth's surface, the increase of which is expected to result from depletion of stratospheric ozone.[65]

C. Estimated Emissions Impact of Proposed Regulation

The emission standards proposed in today's action should reduce average in-use exhaust HC+NOx emissions from small SI engines 30 percent beyond Phase 1 standards by year 2025, by which time a complete fleet turnover is realized. This translates into an annual nationwide reduction of roughly 134,674 tons of exhaust HC+NOx in year 2025 over that expected from Phase 1. Reductions in CO beyond Phase 1 levels, due to improved technology, is also to be expected by year 2025.

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[58]U.S. EPA, Review of NAAQS for Ozone, p. X-10.

[59]U.S. EPA, Review of NAAQS for Ozone, p. X-10.

[60]See 62 FR 38856, Friday, July 18, 1997.

[61]U.S. EPA, Review of NAAQS for Ozone, p. X-22.

[62]U.S. EPA, Review of NAAQS for Ozone, p. X-27.

[63]U.S. EPA, Review of NAAQS for Ozone, p. X-29.

[64]NRC, Rethinking the Ozone Problem, p. 22.

[65]The New York Times, September 15, 1992, p. C4.

Along with the control of all hydrocarbons, the proposed standards should be effective in reducing emissions of those hydrocarbons considered to be hazardous air pollutants (HAPs), including benzene and 1,3-butadiene. However, the magnitude of reduction would depend on whether the control technology reduces the individual HAPs in the same proportion as total hydrocarbons.

These emission reduction estimates are based on in-use population projections using estimates of annual engine sales, engine attrition (scrappage), activity indicator, and current new engine and proposed in-use emission factors. Data on activity indicators were based on the Phase 1 small SI regulation. Estimates of annual engine sales for years from 1973 to 1995 were based on engine data available from the PSR databases[66] and national shipment data provided by Outdoor Power Equipment Institute (OPEI), the Portable Power Equipment Manufacturers Association (PPEMA), and a study done for the California Air Resources Board by Booz Allen & Hamilton (BAH). Sales projections into the future were for the most part based on estimates of population growth for the United States. Attrition rates (survival probability that an engine remains in service into a specific calendar year) for all engines included in this analysis were developed on the assumption that the equipment attrition function may be represented by a two-parameter Weibull cumulative distribution function. The in-use emission factors are based on a multiplicative deterioration factor which is a function of the square root of the hours of equipment usage.

For the analysis summarized in Table 18, the emission inventories were developed for the five regulated engine classes as well as for all pieces of equipment using engines covered by this proposed rule. Using estimated engine sales and attrition, EPA projected the total in-service engine population for each year from 1973 to 2025. EPA projected the total annual nationwide HC, NOx and CO emissions from small SI engines included in the proposal under the baseline (that is, with Phase 1 controls applied) and controlled (Phase 2) scenarios.

For the controlled scenario, EPA assumed that for both handheld and nonhandheld engines the standards would be phased in on a percentage of production basis as proposed in today's notice. Deterioration factors were determined using manufacturer-supplied in-use emission data and other relevant information.

Table 18: Projected Annual Nationwide Exhaust HC+NOx Emissions (tons/year)

Year	Without Proposed Controls (Phase 1)	With Proposed Controls	Tons Reduced from Phase 1 Revised Baseline	Percentage Reduction
2000	378,700	378,700	-----	-----
2005	368,195	297,873	70,322	19.1
2010	389,641	279,061	110,580	28.4
2015	414,626	292,829	121,797	29.4

[66]Power Systems Research, Engine Data and Parts Link data bases, St. Paul, Minnesota, 1992.

2020	439,413	309,221	130,192	29.6
2025	452,973	318,299	134,674	29.7

For simplicity in modeling the projected emission reductions, the Agency has assumed in the emissions inventory model that under the Phase 2 program, each engine would meet the proposed standard for the minimum useful life category: i.e., Class I engines meet the proposed standards at 66 hours; Class 2 engines at 250 hours; and Classes III, IV, and V at 50 hours. Therefore, the Agency has under estimated the emission benefits of the proposed standards, because some engines will be certifying to the longer useful life categories, and therefore a greater emission reduction than predicted in Table 18 will occur. The Agency will attempt to address this issue for a more accurate prediction of the emission benefits of the proposed program for the final rule.

In addition to the reductions in exhaust HC+NOx emissions, the Agency is also estimating the proposed standards would result in a small reduction in HC refueling emissions (refueling emissions are HC emissions caused from fuel spillage and vapor displacement during the refueling of a small engine). As discussed in the RSD, refueling emissions represent approximately an additional 89,000 tons/year of HC in 2025 without Phase 2 controls. The Agency estimates that refueling emissions would be reduced under Phase 2 by the percent reduction in fuel consumption under Phase 2. The Agency estimates the proposed Phase 2 program would result in approximately a 9 percent reduction in fuel consumption by 2025. Therefore, the Agency estimates refueling emissions would be reduced by 9 percent. A 9 percent reduction in refueling emissions equates to an approximate 8,000 ton/year reduction in HC emissions in 2025.

D. Health and Welfare Effects of CO Emissions

Carbon monoxide (CO) is a colorless, odorless gas which can be emitted or otherwise enter into ambient air as a result of both natural processes and human activity. Although CO exists as a trace element in the troposphere, much of human exposure resulting in elevated levels of carboxyhemoglobin (COHb) in the blood is due to incomplete fossil fuel combustion, as occurs in small SI engines.

The concentration and direct health effect of CO exposure are especially important in small SI engines because the operator of a small SI engine application is typically near the equipment as it functions. In some applications, the operator must be adjacent to the exhaust outlet and is in the direct path of the exhaust as it leaves the engine. According to numbers published in the Nonroad Engine and Vehicle Emission Study (NEVES), a 4-stroke, 2.9 kW lawnmower engine emits 1051.1 g/hr CO, while a 2-stroke, 2.9 kW engine emits 1188.4 g/hr CO.

A Swedish study[69] on occupational exposure to 2-stroke chainsaw exhaust concludes, among other things, that a rich fuel-air mixture results in high levels of CO

[69]Occupational Exposure to Chain Saw Exhausts in Logging Operations, Am. Ind. Hyg. Assoc. J48, 1987.

emissions (a mean exposure rate of 37.0 $^{mg/m3)}$. The work conditions that gave rise to the most intense problems for loggers were deep snow, thick forest stands and calm weather. The main discomforts experienced by loggers from chainsaw exhaust were cough and eye, nose and throat irritation. In view of the discomfort experienced by loggers and the complex nature of the exposure to chainsaw exhaust, it was recommended that action be taken to reduce exposure by making technical modifications to the engine or control exhaust emissions.

The toxicity of CO effects on blood and tissues, and how these effects manifest themselves as organ function changes, have also been topics of substantial research efforts. Such studies provided information for establishing the National Ambient Air Quality Standard for CO. The current primary and secondary NAAQS for CO are 9 parts per million for the one-hour average and 35 parts per million for the eight-hour average.

E. Health and Welfare Effects of Hazardous Air Pollutant Emissions

The focus of today's action is reduction of HC emissions as part of the solution to the ozone nonattainment problem. However, direct health effects are also a reason for concern due to direct human exposure to emissions from small SI engines during operation of equipment using such engines. Of specific concern is the emission of hazardous air pollutants (HAPs). In some applications, the operator must be adjacent to the exhaust outlet and is in the direct path of the exhaust as it leaves the engine. Today's proposed regulations should be effective in reducing HAPs such as benzene and 1,3-butadiene, in so far as these are components of the HC emissions being reduced by the Phase 2 standards.

Benzene is a clear, colorless, aromatic hydrocarbon which is both volatile and flammable. Benzene is present in both exhaust and evaporative emissions. Health effects caused by benzene emissions differ based on concentration and duration of exposure. The International Agency for Research on Cancer (IARC), classified benzene as a Group I carcinogen., namely an agent carcinogenic to humans. Exposure to benzene has also been linked with genetic changes in humans and animals. 1,3-butadiene is a colorless, flammable gas at room temperature. This suspected human carcinogen is insoluble in water and its two conjugated double bonds make it highly reactive. 1,3-butadiene is formed in internal combustion engine exhaust by the incomplete combustion of the fuel and is assumed not present in evaporative and refueling emissions.

Epidemiologic studies of occupationally exposed workers were inconclusive with respect to the carcinogenity of 1,3-butadiene in humans. IARC has classified 1,3-butadiene as a Group 2A, probable human carcinogen. Other adverse noncancer health effects due to very high levels of exposure include heart, blood and lung diseases. Since air toxic levels generally decrease in proportion to overall emissions once emission control technology is applied, the amount of benzene and 1,3-butadiene produced by new small SI engines should diminish after this rule becomes effective. Consequently, exposure to HAPs from new small SI engines would be reduced, as would associated health and environmental effects. Although there is little data on direct health effects of

small SI engines, the Swedish study concludes benzene emissions from chain saw engines as being rather high. No study has been conducted involving the health effects of HAP emissions specifically from small SI engines. The Agency requests additional information on this topic.

F. Particulate Matter

Particulate matter, a term used for a mixture of solid particles and liquid droplets found in the air, has been linked to a range of serious respiratory health problems. These fine particles are of health concern because they easily reach the deepest recesses of the lungs. Batteries of scientific studies have linked particulate matter, especially fine particles (alone or in combination with other air pollutants), with a series of significant health problems including premature death, aggravated asthma and chronic bronchitis and increased hospital admissions. EPA has recently (July 1997) announced new NAAQS standards for particulate matter (PM) , by adding two new primary PM2.5 standards set at concentrations of 15 micrograms per cubic meter ($^{\mu g/m3}$), annual arithmetic mean, and $65^{\mu g/m3}$, 24-hour average, to provide increased protection against the PM-related health effects found in community studies. EPA believes that the new standards will protect and improve the lives of millions of Americans.

Separate from the proposed rule, which would not establish emission standards for PM or toxic air contaminants listed under section 112 (b) of the Clean Air Act, an agreement with PPEMA to conduct PM/HAP testing program for handheld engines in cooperation with EPA has been reached. Testing under the program would be conducted on Phase 2 technology handheld engines at EPA, industry, and/or independent facilities. The test program is to be designed to evaluate and quantify emissions of particulate matter and toxics including, but not limited to: formaldehyde, acetaldehyde, benzene, toluene and 1,3 butadiene.

VI. Economic Impacts

EPA has calculated the cost effectiveness of this proposed rule by estimating costs and emission benefits from these engines. EPA made best estimates of the combination of technologies that an engine manufacturer might use to meet the new standards, best estimates of resultant changes to equipment design, engine manufacturer compliance program costs and engine fuel savings in order to assess the expected economic impact of the proposed Phase 2 emission standards. Emission benefits are taken from the results of the environmental benefit assessment (Section II, above). The cost-effectiveness result of this rule is $390 per ton of HC+NOx when fuel savings are not taken into account. When fuel savings are also considered, the cost-effectiveness calculation results in -$700 per ton of HC+NOx. This section describes the background and analysis behind these results.

The analysis for this proposed rulemaking is based data from engine families certified to EPA's Phase 1 standards. It does not include any engine families or production volumes that are covered by CARB's Tier 1 standard. The California Air

Resources Board (CARB) will implement emission standards for many of these engines a year or two prior to the proposed federal Phase 2 regulations. Therefore, this rule only accounts for costs for each engine sold outside California and those engines sold in California that are not covered by the CARB Tier II rulemaking, such as those used in farm and construction equipment. Although EPA expects that engines already designed to meet CARB's earlier standards would incur no additional design cost to meet federal standards, no effort was made to estimate which models would be sold in California and subject to the earlier California standards. Rather for the purpose of this proposal, any Phase 1 engine design that would need to be modified to meet Phase 2 standards was assumed to incur the full cost of that modification including design cost. Similarly, the cost to equipment manufacturers was assumed to be fully attributed to this federal rule even if an equipment manufacturer would have to make the same modifications in response to the CARB Tier 2. Therefore, in both of these cases, the cost to the manufacturer due to these proposed rules is likely over estimated. EPA requests comment on these assumptions. The details of EPA's cost and cost-effectiveness analyses can be found in Chapters 4 and 7 of the Draft RSD.

A. Engine Technologies

Table 19 lists the changes in technology, compared to Phase 1 engines, that have been considered in the cost estimation for this rulemaking. As discussed in Section IV.A of this preamble, the proposed standards would require different engine improvements amongst the five classes and engine designs within those classes.[70] For example, several Class I SV models are expected to require some internal improvements to reduce new engine out emissions and several additional components to increase emission durability. For the purposes of this cost analysis, Class II standards are assumed to require that engines be of clean OHV design. For Classes III-V, the proposed standards for the handheld engines are assumed to require improved scavenging techniques, for the two stroke engines, to be developed to reduce the approximately 30 percent of the air/oil/fuel mixture that traditionally escapes from these engines unburned. This analysis assumes that engine manufacturers would not be required to adopt advanced technologies such as catalysts or fuel injection systems. Manufacturers who did adopt such technologies would choose to do so for other perceived benefits. Therefore, the cost of such optional technology is not included in this cost estimate. Additional detail regarding the impact of

[70]Currently, carbureted two-stroke, four-stroke side-valve and four-stroke overhead valve engine designs comprise the vast majority of engines used in nonhandheld and handheld applications.

these modifications can be found in Chapter 3 and 4 of the Draft RSD.

Table 19
Potential Technology Improvements Per Class and Engine Design

Class	Engine Design	Technologies
I	4 stroke - SV	Carburetor Improvements Combustion Chamber Improvements and Intake System Improved Oil Consumption (Piston oil control rings, valve stem seals)
I	4 stroke - OHV	None necessary
I	2 stroke	None necessary
II	4 stroke - SV	Conversion to clean OHV
II	4 stroke - OHV	Piston and piston ring improvements Improved combustion and intake system
III-V	2 stroke	Carburetor Improvements Improved Scavenging and Combustion Chamber Design Manufacturing Tolerance Improvements
IV	4-stroke	None necessary

B. Engine Costs

The engine cost increase is based on incremental purchase prices for new engines and is comprised of variable costs (for hardware, assembly time and compliance programs), and fixed costs (for R&D and retooling). Variable costs were applied on a per engine basis and fixed costs were amortized at seven percent over five years. Engine technology cost estimates were based on the study by ICF and EF&EE in October 1996 entitled "Cost Study for Phase Two Small Engine Emission Regulations". Details of the assumed costs and analysis can be found in Chapters 4 and 7 of the Draft RSD.

1. Nonhandheld Engine Costs

Based on analysis of the EPA Phase 1 certification database, and use of the ABT program available to nonhandheld engines, it is assumed that four high production Class I SV engine families will need to incorporate all those technologies listed in Table 19.

Incorporation of these technologies will require the engine manufacturer to incur both variable and fixed costs.

Analysis of Class II engine families, from the EPA Phase 1 certification database and use of the ABT calculation, shows that a number of Class II SV engine families will be converted to OHV engine design and a large number of OHV engine families will need to incorporate emission improvements. Such technologies will require both variable and fixed expenditures.

The proposed Phase 2 emission standards for this diverse industry would impact companies differently depending on the existing product offerings. Some companies currently manufacture very clean Class II OHV engines geared toward the commercial market and would be required to make very few changes in their current models. Companies that target the consumer market with SV and perhaps less expensive OHV engines would require application of the emission reduction technologies.

2. Handheld Engine Costs

Analysis of the Phase 1 certification database for handheld engines shows that nearly all engine families of two stroke design will require technologies to reduce engine emissions. Redesign of the existing two-stroke engine is allocated to fixed costs as companies perform R&D, build prototypes and perform numerous emission tests to achieve production-ready models.

C. Equipment Costs

While equipment manufacturers would bear no responsibility for meeting emission standards, they may need to make changes in the design of their equipment models to accommodate the Phase 2 engines. EPA's treatment of the impacts of the proposal therefore includes an analysis of costs for equipment manufacturers. The 1996 PSR EOLINK database was utilized as the source of information for equipment manufacturers, models and sales estimates for all classes. The costs for equipment conversion was derived from the ICF/EF&EE cost study[71] and improved through the work by ICF and EPA on the small business impact analysis. Full details of EPA's cost analysis can be found in Chapter 4 of the Draft RSD. EPA has assumed that capital costs would be amortized at seven percent over ten years.

1. Nonhandheld Equipment Manufacturers

Based on engine technologies estimated for this rulemaking, it is assumed that Class I engine redesign would have no impact on equipment manufacturers since the

[71]ICF and Engine, Fuel and Emissions Engineering, Incorporated; "Cost Study for Phase Two Small Engine Emission Regulations", Draft Final Report, October 25, 1996, in EPA Air Docket A-93-29, Item #II-A-04.

proposed standard would not require external changes or adversely impact the engine's performance.

The Class II engine change from SV to OHV design will have the largest impact on equipment changes. Review of the PSR database for equipment manufacturers that utilize Class II SV engines reveals that the majority (90 percent) of small engine equipment is produced from 32 companies with the remaining 353 companies representing only 10 percent of the overall production.

EPA's work analyzing small business impacts, as summarized in the work with ICF Incorporated,[72] indicates that many of the small businesses, indicated by the PSR database to use SV Class II engines, have already converted or are in the process of converting to using OHV engine design due to market forces or changes in their engine manufacturer's offerings. These companies tend to produce professional or commercial equipment and competition has driven the use of OHV engines. The study also revealed that at least one equipment manufacturer that produces a large volume of equipment, has already switched their lines from SV to OHV. For today's proposal, EPA assumed only the one large manufacturer has already incurred the costs of converting to the use of OHV engine. For the purpose of this proposal, EPA has assumed that any switch from SV to OHV engines by equipment manufacturers is a cost incurred due to this proposal. The cost estimates were based on equipment application (garden tractor, tiller, commercial turf, etc.) and in the case of the commercial turf equipment, on the power of the engine within that application. Flexibilities within this proposal which may lessen the impact of the costs of this rulemaking to equipment manufacturers were also not taken into account.

2. Handheld Equipment Manufacturers

The majority of technologies assumed in this analysis for handheld engines, see Table 19, include only internal redesign and thereby no change in the external design of the handheld engine is expected. Therefore, it is assumed that the outer dimensions and performance characteristics would be similar to the existing models and therefore the handheld equipment would not require any changes. Equipment costs have been included for manufacturers of augers who will need to incorporate changes to the transmission boxes in order to incorporate different speed-torque signatures of Phase 2 compliant engines.

D. Operating Costs

The total life-cycle operating costs for this proposed rulemaking include any expected decreases in fuel consumption. Life cycle costs have been calculated per class

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[72]"Small Business Impact Analysis of New Emission Standards for Small Spark-Ignition Nonroad Engines and Equipment", ICF Incorporated, September 1997, located in EPA Air Docket A-96-55, Item#II-A-01 .

using the nonroad small engine emission model. The model calculates fuel savings from the year 2001-2026 and takes into account factors including equipment scrappage, projected yearly sales increase per equipment type and engine power. Details on the assumptions and calculations on fuel savings are included in Chapter 4 and 7 of the Draft RSD.

1. Nonhandheld Engines

No fuel consumption savings have been assumed from Class I engines. The addition of oil control piston rings and valve stem seals are not expected to affect fuel economy or maintenance requirements and changes to carburetion are expected to be only slight. The Class II SV engine conversion to OHV design is expected to result in improved fuel economy since data show that OHV engines can run at leaner air to fuel ratio's than SV engines.

2. Handheld Engines

Redesigned two-stroke engines are assumed to result in significant fuel savings as fuel/oil/air scavenging is significantly reduced.

E. Cost Per Engine and Cost-Effectiveness

1. Cost Per Engine

Total costs for this proposed rulemaking vary per year as engine families are phased-in to compliance with the Phase 2 standards over several years, capital costs are recovered and compliance programs are conducted. The term "uniform annualized cost" is used to express the cost of this rulemaking over the years of this analysis.

The methodology used for estimating the uniform annualized cost per engine is as follows. Cost estimates from 1996 and 1997 model years, for technology and compliance programs respectively, were estimated and increased at an inflation rate of 4 percent per year to the years in which they were assumed to be incurred. For engine technology costs, one set of technologies per class and engine design was assumed (see Table 19). The Phase 1 database was then analyzed to determine the number of engine families per class that would likely incorporate the emission reduction technologies. The estimated costs per year were then calculated by multiplying the number of engine families and corresponding production volume by the fixed and variable costs per technology grouping, respectively. Retail markups used are 16 percent by the engine manufacturer, 5 percent by the equipment manufacturer and 5 percent by the mass merchandiser. All markups are based on industry specific information from Phase 1. For compliance program costs, each program was outlined and assigned costs based on the likely number of participants or engine families to be included in each program which were determined from the Phase 1 certification database. The costs per year were discounted seven percent to the first year of Phase 2 regulation, 2001 for nonhandheld and 2002 for

handheld engine classes, respectively. A uniform annualized cost was then calculated. Costs per engine are calculated from the uniform annualized cost for the first full year of implementation of the Phase 2 standard, 2005, and the last year of this analysis, 2026. The average cost per engine is calculated from these two values and the results are presented in Table 20.

The yearly fuel savings (tons/yr) per class were calculated from the nonroad small engine emission model. The tons/yr were converted to savings ($) per year through conversion to gallons per year multiplied by $0.765 (a 1995 average refinery price to end user). The yearly fuel savings were discounted by 3 percent to the first year of Phase 2 regulation, 2001 for nonhandheld engines and 2002 for handheld engines. The yearly results were totaled and then divided by an annualized factor to yield the uniform annualized fuel savings. The engine lifetime fuel savings for each engine class was calculated for the production years of 2005 and 2026. The average of these two values was utilized as the average fuel savings per engine per class is shown in Table 20.
In particular EPA notes that its estimate of fuel savings for Class II engine conversion to OHV technology is greater than the estimated cost of this conversion and thus would be economically beneficial to the consumer. EPA requests comment on its analysis of the fuel economy benefit for Class II conversion from SV to OHV technology and information as to why the market has not responded with a greater penetration of the more fuel efficient OHV technology.

The average resultant cost per engine class is calculated by subtracting the average fuel savings from the average cost, see Table 20. See Chapter 7 of the Draft RSD for more details of this analysis.

Table 20
ENGINE LIFE TIME FUEL SAVINGS AND
RESULTANT COST PER ENGINE
Costs Based on Uniform Annualized Costs

Class	Cost Per Engine	Savings Per Engine	Resultant Cost Per Engine
I	$0.87	$0.00	$0.87
II	$10.54	$33.20	($22.66)
III	$0.74	$0.45	$0.29
IV	$1.92	$0.99	$0.92
V	$16.21	$4.12	$12.07

2. Cost Effectiveness

EPA has estimated the cost-effectiveness (i.e., the cost per ton of emission reduction) of the proposed HC+NOx standard over the typical lifetime of the small SI equipment that would be covered by today's proposed rule. EPA has examined the cost-effectiveness by performing a nationwide cost-effectiveness in which the net present value of the cost of compliance per year is divided by the nationwide emission benefits per year over a period of 26 years. This is sufficient time to achieve fleet turnover. The resultant cost-effectiveness is $390 cost/ton HC+NOx without fuel savings. Chapter 7 of the Draft RSD contains a more detailed discussion of the cost-effectiveness analysis. EPA requests comments on all aspects of the cost-effectiveness analysis.

The overall cost-effectiveness of this rule on HC+NOx emission reductions, with fuel savings, is shown in Table 22. Table 22 contains the cost effectiveness of other nonroad rulemakings, which contain fuel savings, to which the cost-effectiveness of this rulemaking can be compared.

Table 22
Cost-effectiveness of the Proposed Standards With Fuel Savings

Standard	NPV Cost/NPV Ton (With Fuel Savings)	Pollutants
Proposed Small SI Engines <19 kW Phase 2	-$700	HC+NOx
Small SI Engines <19 kW Phase 1	$217	HC+NOx
Spark Ignition Marine Engines	$1000	HC
Proposed Nonroad CI Standards	$180-$400	HC+NOx

VII. Public Participation

A. Comments and the Public Docket

The Agency welcomes comments on all aspects of this proposed rulemaking. All comments (preferably in duplicate), with the exception of proprietary information, should be directed to the EPA Air Docket Section, Docket No. A-96-02 (see ADDRESSES). Commenters who wish to submit proprietary information for consideration should clearly separate such information from other comments by:

- Labeling proprietary information "Confidential Business Information" and,
- Sending proprietary information directly to the contact person listed (see FOR FURTHER INFORMATION CONTACT) and not to the public docket.

This will help ensure that proprietary information is not inadvertently placed in

the docket. If a commenter wants EPA to use a submission labeled as confidential business information as part of the basis for the final rule, then a nonconfidential version of the document, which summarizes the key data or information, should be sent to the docket.

Information covered by a claim of confidentiality will be disclosed by EPA only to the extent allowed by and in accordance with the procedures set forth in 40 CFR Part 2. If no claim of confidentiality accompanies the submission when it is received by EPA, the submission may be made available to the public without notifying the commenters.

B. Public Hearing

Anyone wishing to present testimony about this proposal at the public hearing (see DATES) should, if possible, notify the contact person (see FOR FURTHER INFORMATION CONTACT) at least two business days prior to the day of the hearing. The contact person should be given an estimate of the time required for the presentation of testimony and notification of any need for audio/visual equipment. A sign-up sheet will be available at the registration table the morning of the hearing for scheduling those who have not notified the contact earlier. This testimony will be scheduled on a first-come, first-served basis, and will follow the testimony that is arranged in advance.

The Agency recommends that approximately 50 copies of the statement or material to be presented be brought to the hearing for distribution to the audience. In addition, EPA would find it helpful to receive an advance copy of any statement or material to be presented at the hearing at least two business days before the scheduled hearing date. This is to give EPA staff adequate time to review such material before the hearing. Advance copies should be submitted to the contact person listed.

C. Obtaining Electronic Copies of Documents

Materials relevant to this proposed rule are contained in Docket No. A-96-55, located at the Air Docket, 401 M Street, S.W., Washington, DC 20460, and may be reviewed in Room M-1500 from 8:00 a.m. until 5:30 p.m. Monday through Friday. As provided in 40 CFR part 2, a reasonable fee may be charged by EPA for photocopying docket materials.

The preamble, regulatory language and draft Regulatory Support Document are also available electronically from the EPA internet Web site. This service is free of charge, except for any cost you already incur for internet connectivity. The official Federal Register version is made available on the day of publication on the primary Web site listed below. The EPA Office of Mobile Sources also publishes these notices on the secondary Web site listed below.

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VIII. Administrative Requirements

A. Administrative Designation and Regulatory Analysis

Under Executive Order 12866,[73] the Agency must determine whether the regulatory action is "significant" and therefore subject to OMB review and the requirements of the Executive Order. The order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof;

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

A regulatory support document which presents EPA's analysis of the cost impacts of this proposed rule is available for review in the public docket. EPA estimates that the proposed standards and other regulatory provisions, if adopted, would not have an annual effect on the economy of more than $100 million, a criterion which is a major determinant in defining an "economically significant regulatory action." Although not "significant" based on this criterion, the rule may adversely affect in a material way that sector of the economy involved with the production of small spark-ignition engines or equipment utilizing such engines. As such, this action was submitted to OMB for review. Any written comments from OMB and any EPA response to OMB comments are in the public docket for this proposal.

B. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. Copies of the ICR document may be obtained

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[73] 58 FR 51735 (October 4, 1993).

from Sandy Farmer, Regulatory Information Division, EPA, 401 M Street, SW (2137), Washington, DC 20460 or by calling (202)260-2740.

Table 24 provides a listing of this proposed rulemaking's information collection requirements along with the appropriate information collection request (ICR) numbers. The cost of this burden has been incorporated into the cost estimate for this rule. The Agency has estimated that the public reporting burden for the collection of information required under this rule would average approximately 6702 hours annually for a typical engine manufacturer. The hours spent by a manufacturer on information collection activities in any given year would be highly dependent upon manufacturer specific variables, such as the number of engine families, production changes, emission defects etc.

Table 24: Public Reporting Burden

EPA ICR No.	Type of Information	OMB Control No.
151490	Certification	2060-0338
23420	Averaging, banking and trading	2060-0338
N/A	Production line testing	N/A
1675.01	In-use testing	2060-0292
N/A	In-use credits	N/A
0095.07	Pre-certification and testing exemption	2060-0007
0012	Engine exclusion determination	2060-0124
0282	Emission defect information	2060-0048
1673.01	Importation of nonconforming engines	2060-0294

Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Chief, Information Policy Branch, EPA, 401 M Street, SW (PM-223Y), Washington DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503, marked "Attention: Desk Officer for EPA." The final rule will contain responses to OMB or public comments on the information collection requirements contained in this proposal.

C. Unfunded Mandates Reform Act

Section 202 of the Unfunded Mandates Reform Act of 1995 ("Unfunded Mandates Act") requires that the Agency prepare a budgetary impact statement before promulgating a rule that includes a Federal mandate that may result in expenditure by State, local, and tribal governments, in aggregate, or by the private sector, of $100 million

or more in any one year. Section 203 requires the Agency to establish a plan for obtaining input from and informing, educating, and advising and small governments that may be significantly or uniquely affected by the rule.

Under section 205 of the Unfunded Mandates Act, the Agency must identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a budgetary impact statement must be prepared. The Agency must select from those alternatives the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule, unless the Agency explains why this alternative is not selected or the selection of this alternative is inconsistent with law.

Because this proposed rule is estimated to result in the expenditure by State, local and tribal governments or the private sector of less than $100 million in any one year, the Agency has not prepared a budgetary impact statement or specifically addressed the selection of the least costly, most cost-effective or least burdensome alternative. EPA has estimated the rule to cost the private sector an annualized cost of $90 million per year . However, the Agency has appropriately considered cost issues in developing this proposal as required by section 213(a)(3) of the Clean Air Act, and has designed the proposed rule such that it will in EPA's view be a cost-effective program. Because small governments would not be significantly or uniquely affected by this proposed rule, the Agency is not required to develop a plan with regard to small governments.

D. Regulatory Flexibility

The Regulatory Flexibility Act (RFA) generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and small governmental jurisdictions. For the reasons set out below, this proposed rule would not have a significant impact on a substantial number of small entities.

EPA has identified industries that would be subject to this proposed rule and has contacted small entities and small entity representatives to gain a better understanding of potential impacts of the proposed Phase 2 program on their businesses. This information was useful in estimating potential impacts of this rule on affected small entities, the details of which are fully discussed in Chapter 8 of the Draft RSD. Small not-for-profit organizations and small governmental jurisdictions are not expected to be impacted by this proposal. Thus EPA's impact analysis focuses on small businesses. For purposes of the impact analysis, "small business" is defined by number of employees or dollars of annual receipts according to Small Business Administration (SBA) regulations. The analysis focuses especially on impacts to manufacturers of Class II nonhandheld and Classes III-V handheld engines and equipment, since Class I side-valve engines are only expected to need minor modifications.

The economic impact of the proposed rule on engine and equipment manufacturers defined as small by the SBA was evaluated using a "sales test" approach which calculates annualized compliance costs as a function of sales revenue. The ratio is

an indication of the severity of the potential impacts. The results of the analysis suggest that of those small entities analyzed, one small business engine manufacturer and two small business equipment manufacturers would experience an impact of greater than one percent of their sales revenue. However, none of these small entities would experience an impact greater than three percent of their sales revenue. These three companies represent approximately five percent of the total small business manufacturers on which the analysis was based. Given this, and the ratio levels at which these companies are projected to be impacted (i.e., less than three percent), EPA expects today's proposal to have a light impact on small business entities. The analysis assumes no passthrough of costs in price increases and thus can be characterized as depicting worst case impacts.

While the Agency does not consider these impacts to be significant, the Agency desires to minimize impacts to the extent possible for those companies which may be adversely affected and to ensure that the proposed emissions standards are achievable. Thus, flexibility provisions for the proposed rule (discussed in Section IV.E) were developed based on information gained through discussions with potentially affected small entities. Many of the flexibilities being proposed in today's rule should benefit both engine and equipment manufacturers qualifying as small. Some, but not all, of these provisions were considered in the impact assessment on small entities (see Chapter 8 of the Draft RSD). Those flexibilities not considered, including a hardship relief provision described in Section IV.E, were developed too late in the rule development process to be included in the impact assessment, but as they were added in order to further ensure the achievability of the proposed standards it is expected that they would further reduce the impacts of the proposed rule. EPA requests comment as to whether these proposed provisions adequately address the needs of affected manufacturers, and small entities in particular.

The results of the impact analysis show minimal impacts on small businesses. EPA expects impacts may be negligible if small companies take advantage of those additional flexibilities not considered in the analysis, and if companies pass through most of their costs to customers as was indicated as likely by most small companies contacted. Furthermore, EPA's outreach activities with small entities indicated that many engine and equipment manufacturers have already made the switch from side-valve engine technology to producing or using overhead valve engine technology for reasons other than today's proposed rule, and therefore may not incur substantial additional costs as a result of this program. Therefore, I certify that this action will not have a significant economic impact on a substantial number of small entities and therefore a regulatory flexibility analysis for this proposal has not been prepared. The Agency continues to be interested in the potential impacts of the proposed rule on small entities and welcomes additional comments during the rulemaking process on issues related to such impacts. In spite of the expected minimal impacts on small entities, the Agency is continuing its efforts to notify other small business engine and equipment manufacturers of this rule and inform them of their opportunities for providing feedback to the Agency.